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TREATISE

ON

MINERALOGY.

SECOND PART,

CONSISTING OF

DESCRIPTIONS OF THE SPECIES, AND TABLES ILLUSTRATIVE OF THEIR NATURAL AND CHEMICAL AFFINITIES.

WITH FIVE HUNDRED WOOD CUTS.

BY

CHARLES UPHAM SHEPARD, A. B.

Lecturer on Natural History in Yale College; Member of the American Geological Society; Corresponding Member of the Academy of Natural Sciences of Philadelphia; of the Natural History Society of Montreal, and of the Geological Society of France, &c.

IN TWO VOLUMES.

VOLUME I.

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TO

BENJAMIN SILLIMAN, LL. D.

PROFESSOR OF CHEMISTRY, MINERALOGY AND GEOLOGY

IN YALE COLLEGE,

&c. &c.

DEAR SIR,

The distinguished services you have rendered to the cause of Mineralogy and Geology in America, not merely in contributing to their early introduction, but to their efficient cultivation among us, prompt me to dedicate the present work to you.

The wisdom and zeal of those exertions which secured to Yale College the most splendid collection of minerals in the country, the valuable instruction and enthusiasm imparted by your lectures to a great body of young men now dispersed through the whole nation, and the public spirit which has led you at a personal sacrifice to maintain in the American Journal of Science a free medium for the diffusion of this kind of knowledge, are too well known and justly appreciated to require the feeble acknowledgment

of this tribute; but as the work was undertaken at your suggestion, and has been aided in its progress by your advice, I may perhaps be permitted the pleasure of improving this occasion to express publicly the sense I feel of the value of your labors, and to acknowledge the many kind services for which I stand indebted to your friendship.

I have the honor to be,

Your very faithful

And obliged Servant,

CHARLES U. SHEPARD.

New Haven, May, 1835.

PREFACE.

The eclectic character of my introductory volume, which was intended to give a view of all the departments of Mineralogy excepting Physiography, rendered it difficult for persons employing it to avail themselves of other treatises for full descriptions of the species. The inapplicability was principally owing to my adoption of the improvements of Mohs in relation to simple and compound varieties and to the numerical scale for expressing the hardness, and to my following Brooke in the treatment of the regular forms; not to mention the circumstance, that my artificial tables enumerated a number of species whose descriptions had not found their way into any English work. This was foreseen in the preparation of that volume; and notice was accordingly given in it, that a second part, devoted exclusively to descriptions, and constructed in accordance with the principles of the first, was in preparation.

In addition to the desire of supplying what was thus wanting to carry out the plan of study which had appeared to me to possess the greatest advantages, I was stimulated to the attempt, in the hope of being able to contribute something towards the more satisfactory determination of American localities; an undertaking for which my mineralogical travels had afforded me considerable facilities. Indeed, so numerous had been the discoveries in important mineral depositories since the last edition of Cleaveland's

Mineralogy and the publication of ROBINSON's Catalogue, and so many doubtful points existed in relation to many of those quoted in these works—not a few having been erroneously announced, either through inaccurate determinations of the species, or their occurrence in trifling and accidental quantitity—that the proposed work seemed justifiable solely on this ground, provided there was a reasonable hope of placing the subject in a more just light. Besides, it was had in view to indicate the crystalline forms noticeable among our minerals, a point which had been so much overlooked as to have created a very unfavorable impression of the mineralogical riches of the country. There seemed room also, to perform a desirable service by appropriating to the work the latest discoveries of the German mineralogists, to whom the science is indebted for its most important advances during the last ten years.

The general rules according to which the descriptions have been drawn up, are those laid down in §. 126, of the Introductory volume. The trivial names to the species having been adopted in the analytical tables for the reasons given in §. 117, it became necessary to employ them also in the present work. Indeed so small is the number of species in the mineral kingdom compared with the species in the other departments of Natural History, and so deficient in fixity are many of the still accounted species, that it is, and probably for some time to come will be, most prudent to call them by these names. The chemical designations having by general usage been dropped where other names existed, BEUDANT in his system of Mineralogy has attempted by the invention of new names, where it was necessary, to render universal the application of the

trivial nomenclature. Approving of this reform, I have adopted his names in numerous instances; and where species were still left unprovided with trivial epithets, I have ventured in a few instances to propose them.

To the trivial name, the systematic denomination is added in a smaller type, as it appeared to me important not to lose sight of what in its other branches, is conceded to be one of the greatest advantages of Natural History; viz. that of expressing in the names, the connexion in natural properties, subsisting among the species. Whether the names here employed, which are mostly those contrived by Mohs, will ultimately be approved of by Naturalists, is not at present certain; but their use in the intercourse of Mineralogists will often be found to possess important convenience, and though compelled in the future and more perfected state of the science to give place to simpler expressions—perhaps to those, constructed according to the genius of the Latin language by which means the difficulty of their translation from one language into another will be avoided—they still appeared to me to be worthy of being retained, especially as they are introduced merely as synonyms.

The alphabetical arrangement of the species has been adopted because it seemed most likely to subserve the convenience of students using my characteristic, or any other, in the determination of specimens; as well as that of persons having occasion to refer to the descriptions for less general purposes, as for example, to learn only the crystalline form of a particular species, or to obtain information respecting its locality. Had the natural-historical arrangement, the chemical, or any mixture of the two, been em-

ployed, the inconvenience of consulting an index must necessarily have been encountered.

But while the alphabetical distribution has the advantage at least, of being independent of all scientific arrangement—concerning whose present existence many entertain doubts, —the two tabular views, one at the commencement of this volume, and the other at the conclusion of the second, will present the species grouped in accordance with two classes of affinities, the first, the natural-historical, the second, the chemical, resemblance. In the construction of these tables, I cannot, of course, suppose that I have acquitted myself to the satisfaction of all, when I have but so imperfectly satisfied myself.

The chemical arrangement, however, is such as the present state of chemical science seemed to force upon me without much choice. A more extensive and accurate analysis of minerals, however, will undoubtedly produce in it many changes, while also it will permit the composition of a considerable number of species, now left in uncertainty, to be expressed with atomic precision.

Both in this tabular view, and elsewhere in the work, I have refrained from adopting the algebraical language of Berzelius for denoting the chemical constitution of minerals, although it would have afforded much convenience in the present state of chemical nomenclature, more particularly in relation to isomorphous compounds, because I have every where sought to exclude whatever has an abstruse and forbidding air; knowing that many have been discouraged from entering upon this pleasing and fa-

cile pursuit by the discovery of even the occasional use of unintelligible language in a professedly elementary treatise of its principles.

The natural-historical arrangement of the species is principally that brought forward by MOHS. I have nevertheless ventured, though not without considerable hesitation, to propose a number of alterations, which will be obvious on a comparison of the two systems. In making these changes, I have endeavored so to constitute the genera that the species of each should be bound together by a similar amount of resemblance. If in the execution of this difficult task, I have not violated the affinities of the species, an important advantage will have been secured in the simplification of the nomenclature by the great reduction of genera, especially in the orders, *Ore*, *Pyrites*, *Glance* and *Blende*.

The formation of the new order, *Picrosmine*, appeared to be indispensable in providing a place for a number of species, which MOHS had declined incorporating with his system from their deficiency in regular forms. The production of the genus *Lusine-Ore* was rendered necessary for a similar reason, in order to receive such species of the requisite structure and specific gravity, as are believed to owe their formation to the decomposition of other species. The above mentioned writer does not allow such minerals, provided they are in a friable state, to constitute distinct species; remarking of them, that "it is in direct opposition to the principles of Natural History, to consider decomposed varieties of one species as varieties of another." To the correctness of this as a general rule I readily assent, allowing it full force when the resulting mass is not homo-

geneous in its mechanical composition and at the same time destitute of a fixed chemical constitution.

The general order observed in the particulars of the descriptions is that adopted by MOHS, whose language in relation to a number of the properties has been employed, *verbatim*. The description of the regular forms, however, is quite different and requires some explanation. In many instances, all the observed forms are represented; in others, where the number was too great to admit of this, such a selection has been made as appeared best adapted to give a correct idea of the entire series of modifications within the species. The locality is sometimes subjoined, when the form represented is not common, or when it is known to occur at a particular spot in unusual perfection.

The primary forms of BROOKE have been adhered to, more for the reason that they are still in such common use in English works and from their expressing in general the cleavage forms with correctness, than because they are in every instance the most simple solids from which the secondaries are capable of being derived. In the last mentioned view, they would certainly admit of a very important reduction. The tetrahedron, cube, regular octahedron and rhombic dodecahedron might form a single system,—the right square prism and the octahedron with a square base, another,—the right rectangular prism and the octahedron with a rectangular base, a third,—and the right rhombic prism and the octahedron with a rhombic base, a fourth system.

For the sake of easy intelligibility also, the angles and faces of the crystals are described without adopting an al-

geometrical system of notation. Nor have I thought it best to quote the corrected angles in place of such as were obtained by observation, except in those crystals depending upon forms of invariable dimensions. In other cases, it would no doubt have been safe to have employed such angles in the great majority of instances, yet the slight variations occurring in the constancy of angles in the individuals of several species, still leaves us in doubt what dimensions to assume as the most free from error by which to correct the others. Until this confusion is removed, the student will not suffer much inconvenience by adopting the present somewhat circuitous method of becoming acquainted with crystals. And besides, to have adopted the mathematical treatment of crystals alluded to, would have prevented a large number of persons from understanding the subject, to whom in its present popular form, it is perfectly intelligible.

In the preparation of this work it has been necessary to examine a great number of doubtful minerals, as well as newly proposed species with which the Scientific Journals abound. It may therefore be expected that something should be said in this place concerning the disposition which has been made of these materials. But a single new species, the *Microlite*, has been proposed; though a number of observations have been made, calculated to place the specific claims of a few minerals before proposed in a stronger light.

If, however, my investigations have not led me to increase the number of species, they have on the other hand, compelled me to treat a number heretofore regarded distinct, as varieties only of older species,—examples of

which are the *Fibrolite*, *Sillimanite*, *Pinite*, *Fowlerite*, *Deweylite*, *Marmolite*, &c.

But while I have constantly been concerned to find good reasons for reducing the number of the species, I cannot concur in the proposal of ROSE for uniting *Pyroxene* and *Hornblende*, notwithstanding the ingenious reasons he uses in favor of this procedure. To overlook their marked disagreement in crystalline structure and to cause them to coalesce, would shake to the foundations the most secure support of all specific distinction. These species as they occur in the United States do not at all favor his conclusion, inasmuch as they exist together at several places in dolomite, preserving their peculiar angles and cleavages.

The proposed union of *Schiller Spar* with *Pyroxene* by KOBELL, is equally in violation of two of the best specific properties in the absence of crystalline form; viz. specific gravity and hardness. Indeed, all conclusions in case of such complex compounds, drawn from chemical composition, must necessarily be indecisive.

The introduction of historical matter, as well as a notice of the authorities quoted, has been avoided, excepting only the mention of the author to the systematic name of the species, and occasionally the source whence the angles and the specific gravity have been derived.* To have carried these acknowledgments farther, would have swelled the dimensions of the work to an inconvenient size, without having proportionably enhanced its value as an elementary treatise. The more accomplished mineralogist will of

* The works to which I have been most indebted in the preparation of this Treatise, are mentioned at the conclusion of the preface.

course always have at hand the requisite works for consultation when information of this kind is desired. The best single work adapted to the purpose, with which I am acquainted, is the *Handbuch* of LEONHARD.

It will not be demanded of me to pronounce a panegyric upon Mineralogy. When systematically and thoroughly pursued, it does not yield in rational interest to any department of Natural History; but if its fundamental principles are overlooked, or but imperfectly acquired, the pursuit can afford no satisfaction to a sound mind. A degree of excitement may indeed attend the accumulation of rarities, but this is usually of temporary duration; and if a good cabinet should be acquired, the perpetual conviction of ignorance, which its inspection is calculated to force upon the possessor, is sufficient to produce ultimate indifference, if not disgust. When on the contrary, the preliminary principles are acquired, the progress of the pupil is uniform, rapid and delightful. Every acquisition to his collection supplies some link in the chain of his knowledge. His cabinet will exhibit the symmetry and beauty of his attainments. Every specimen worthy of possession, will have its location defined beforehand, from which it cannot be removed without a palpable violation of order. A cabinet thus formed becomes of itself an expression of the principles of the science, by means of which its possessor is enabled to corroborate the accuracy of its details, to correct its errors, and to extend its limits. Nature here becomes the guide and teacher, at the same time permitting the pupil to experience the enthusiasm, and to sustain the dignity, of an original investigator.

But though mineralogy thus pursued, fully rewards her devotees, its numerous connected inquiries and pursuits confer upon it, also, a high and deserving interest.

To the chemist who proposes to extend his knowledge to the productions of the mineral kingdom, this science becomes indispensable in order to enable him to know what he has analyzed, or how to distinguish and describe the body whose composition he has studied. To the geologist also, it is a collateral study of no small importance; since the discrimination of many rocks, and the description of all, depend upon a knowledge of no inconsiderable number of mineral species.

Of connected inquiries, however, the most fertile and highly interesting, is that arising out of the regular forms assumed by crystals, where, considering the absence of the living principle, a most surprising mixture of simplicity and complexness exists. To trace out the geometrical and numerical laws by which the secondary forms are derived from a few fundamental solids, though essential as a part of determinative and descriptive mineralogy, still leaves out of the question numerous, shorter and more beautiful modes of treating the subject, in consequence of the circuitous route by which it is necessarily effected in popular treatises. The invention, therefore, of new and more scientific methods of studying the geometry of crystals will always afford entertainment and delight to those who possess the adequate mathematical knowledge. The theoretical consideration of the shapes possessed by the elementary particles as connected with the same subject, though without any positive means of verification and utility in the practice of mineralogy, will afford to such inquirers a pleasing occupation.

As a collateral pursuit, that of Optics is perhaps one of the most beautiful and productive, as seems to be evinced by the rich harvest of discoveries made by BREWSTER in relation to the polarization of light and double refraction,—discoveries which are fruitful in new and highly curious experimental phenomena, as well as useful in affording an unexpected method for detecting in ambiguous cases, the primary forms of crystals. In addition to which mention may be made of HERSCHEL's ingenious explanation relative to the deviation of the succession of colors, which many crystals exhibit, from that scale of tints established by NEWTON, by conceiving the axis of double refraction to be different for different colors; and of another discovery of the same philosopher, concerning the circular polarization of light to the right or left, and the plagihedral crystallization of Quartz; (see figures 371 and 373,) from which it appears that right handed polarization always accompanies right handed plagihedral faces, and left handed polarization, left handed faces. Very interesting observations are likewise connected with the origin of the various kinds of lustre as dependent on structure, and the phenomena of colors in Labradorite as the result of internal cavities having the shape of the primary solid.

Not the least curious developement is that made by SAVART, from which it appears that the acoustical phenomena depending on the elasticity of the parts of the crystal lead to information connected with the internal structure of minerals. The elasticity of all the diametral lines in transverse plates cut from a common crystal of Quartz, parallel to the axis, having similar optical properties, is equal; but though all the plates cut parallel to the axis have similar optical relations, their acoustical properties have a relation to the

edges of the prism; such however, that any three plates at angles of 120° have an equal acoustical elasticity. He found also that by the acoustical properties he could determine the cleavage planes of Quartz, and in general whether a given portion of a mineral belongs to a simple crystal, or to a mass of compound individuals, as the vibration in the different cases gives corresponding differences of note, amounting to a full tone.

Besides its own peculiar attractions, and the recommendations it possesses from its affiliation with many branches of general Physics, there is necessarily superadded to mineralogy in this country a strong interest arising out of the unexplored state of its mineral riches. By far the largest part of our territory still waits for the first labors of the Mineralogist; and as proof that the full harvest of discovery has not yet been gathered in even in the New England states, New York, New Jersey and Pennsylvania, in which mineralogical inquiries commenced, and where they have been followed up with the greatest activity, it needs only to be mentioned that these states still continue to develope with each passing year, discoveries of increasing interest. Should the present work contribute to promote investigations so inviting in themselves, and so important to mankind, whereby the science may reap fresh acquisitions, and the country increased resources, I shall experience a reward greatly beyond the merits of such imperfect labors.

CHARLES U. SHEPARD.

New Haven, May, 1835.

LIST OF THE PRINCIPAL WORKS CONSULTED IN THE PREPARATION OF THIS TREATISE.

Treatise on Mineralogy, by FREDERICK MOHS, translated from the German, with considerable additions, by WILLIAM HAIDINGER. Edinburgh, 1825.

Traité élémentaire de Minéralogie par F. S. BEUDANT. Paris, 1830.

Vollständige Charakteristik des Mineral-Systems, von AUGUST BREITHAUPT. Dresden and Leipzig, 1832.

Charakteristik der Mineralien, von FRANZ von KOBELL. Nurenberg, 1831.

Traité de Minéralogie, par L'ABBE' HAUY. Paris, 1823.

Die Mineralogie in sechs und Zwanzig Vorlesungen, von Dr. CARL FRIEDR. ALEX. HARTMANN. Ilmenau, 1829.

Handbuch der Oryktognosie von CARL CAESAR von LEONHARD. Heidelberg, 1826.

Die Anwendung des Löthrohrs in der Chemie und Mineralogie, von T. JACOB BERZELIUS. Nürnberg, 1828.

An Elementary Introduction to the Knowledge of Mineralogy, by WILLIAM PHILLIPS. London, 1823.

An Elementary Treatise on Mineralogy and Geology, by PARKER CLEAVELAND. Boston, 1822.

Nouveau Système de Minéralogie, par J. J. BERZELIUS. Paris, 1819.

Elementos de Orictognosia, por el C. ANDRES DEL RIO. Filadelfia, 1832.

Minéralogie appliquée aux Arts, par C. P. BRARD. Paris, 1821.

Der Naturgeschichte des Mineralreiches, von FRIEDERICH MOHS. Wien, 1832.

A Manual of Mineralogy, by ROBERT ALLAN. Edinburg, 1834.

Numerous works devoted to Crystallography, among which may be mentioned those of HAUY, BOURNON, BROCHANT, BROOKE and NAUMANN.

Various Memoirs in the different English, French and German Journals, and Transactions of Academies and Learned Societies; the Yearly Account of the Progress of Chemistry and Mineralogy, by BERZELIUS; the American Journal of Science; the Transactions of the Academy of Natural Sciences of Philadelphia, and of the New York Lyceum.

BREITHAUPT'S SCALE OF HARDNESS.

1. Foliated Talc. 2. Foliated Gypsum. 3. Foliated Mica. 4. Calcareous Spar, distinctly foliated. 5. Fluor, distinctly foliated. 6. Apatite. 7. Sodalite, vitreous Actynolite and foliated Scapolite. 8. Adularia. 9. Quartz. 10. Topaz. 11. Foliated Corundum. 12. Diamond.

ERRATA.

Vol. I.

Page 12, line 31, *for* Yttria *read* Lithia. [and *dele* Partsch.
" 43, " 20, *for* Habroneme-Malachite *read* Copper-Baryte
" 51, " 7, *after* P *insert* on do.
" 83, " 21, *for* 93° 40′ *read* 136° 00′.
" 83, " 23, *for* 87° 8′ *read* 133° 34′.
" 101, " 2, *for* 135° *read* 127° 27′.
" 122, " 10, *for* 80° *read* 60°.
" 143, " 25, *for* 107° 05′ *read* 177° 05′.
" 147, " 25, *for* 49·00 *read* 58 71.
" 147, " 26, *for* 14·00 *read* 21·31.
" 147, " 27, *for* 35·00 *read* 19·98.
" 159, " 30, *for* Cupreous *read* Euotomous.
" 160, " 20, *for* Prismatoidal *read* Cupreous.
" 178, " 1, *for* Pyramidal *read* Prismatic.
" 188, " 10, *for* 54·44 *read* 59·44.
" 233, " 5, *for* 180° *read* 130°.
" 233, " 18, *for* Antimony *read* Tellurium.
" 256, " 10, *for* 115° 53′ *read* 64° 51′.
" 281, " 26, *for* Iron *read* Chlorone.

Vol. II.

Page 31, line 28, *for* protoxide *read* peroxide.
" 32, " 9, *insert* color black.
" 48, " 13, *for* Molybdic *read* Plombic.
" 128, " 24, *for* Brachytypous *read* Pyromorphous.
" 176, " 14, *for* Scheerverite *read* Scheererite.
" 186, " 28, *after* Rome *insert* and.
" 279, " 24, *for* Wolchouskoit *read* Wolchonskoit.
" 288, " 19, *for* Prismatic *read* Hemi-Prismatic.
" 293, " 9, *for* rather *read* rarely.
" 296, " 16, *for* affixed *read* prefixed.

TABULAR VIEW

OF THE

CLASSES, ORDERS, GENERA AND SPECIES OF THE NATURAL SYSTEM.*

GENERAL PROPERTIES OF THE CLASSES.

CLASS I.

G. under 3·8.

No bituminous odor.

CLASS II.

G. above 1·8.

Tasteless.

---

* The following abbreviations are employed in the tabular view:

G. for Specific Gravity.
H. for Hardness.
Beu. for Beudant.
B. for Breithaupt.
H. for Haidinger.
M. for Mohs.
P. for Partsch.
S. for Shepard.

CLASS III.

G. under 1·8.

GENERAL PROPERTIES OF THE ORDERS OF CLASS I.

Order I. Gas. (M.)

G. 0·0001 . . . 0·0014.
Gasiform.
Not acid.

Order II. Water. (M.)

G. 1·0.
Liquid.
Tasteless.

Order III. Acid. (M.)

G. 0·0015 . . . 3·7.
Acid.

Order IV. Salt. (M.)

G. 1·2 . . . 2·9.
Solid.
Not acid.

GENERAL PROPERTIES OF THE ORDERS OF CLASS II.

Order I. Haloide.[1] (M.)

Unmetallic. Streak uncolored.
H. 2·0 . . . 5·0.
G. 2·2 . . . 3·5.

---

[1] Αλς, *salt*, and ειδος, *like*.

Order II. Baryte.[2] (M.)

Unmetallic. Streak uncolored, or orange-yellow.
H. 2·5 . . . 6·0.
G. 3·3 . . . 7·3.

Order III. Kerate.[3] (M.)

Unmetallic. Streak uncolored.
H. 1·0 . . . 2·0.
G. 5·5 . . . 6·5.

Order IV. Mica. (M.)

Cleavage monotomous.[4]
H. 1·0 . . . 4·5.
G. 1·8 . . . 3·4.

Order V. Picrosmine.[5] (S.)

When moistened, emits an argillaceous odor.
H. 2·0 . . . 3·0.
G. 2·0 . . . 2·8.

Order VI. Spar. (M.)

Unmetallic.
H. 3·5 . . . 7·0.
G. 2·0 . . . 3·7.

---

[2] Βαρὺς, *heavy*.

[3] Κέρας, *horn*.

[4] Μόνος, *single*, and τεμνω, *I cleave*,—implying that the cleavage is distinct only in a single direction.

[5] Πικρὸς, *bitter*, and οσμὴ, *odor*,—in allusion to the smell when moistened.

Order VII. Gem. (M.)

Unmetallic. Streak uncolored.
H. 5·5 . . . 10·0.
G. 1·9 . . . 4·7.

Order VIII. Ore. (M.)

H. 1·0 . . . 7·0.
G. 3·4 . . . 7·4.

Order IX. Metal. (M.)

Metallic.
H. 0·0 . . . 5·0.
G. 5·7 . . . 20·0.

Order X. Pyrites. (M.)

Metallic.
H. 3·0 . . . 6·5.
G. 4·1 . . . 7·7.

Order XI. Glance. (M.)

Metallic. Color grey, black.
H. 1·0 . . . 4·0.
G. 4·2 . . . 7·6.

Order XII. Blende. (M.)

H. 1·0 . . . 4·0.
G. 3·9 . . . 8·2.

Order XIII. Sulphur. (M.)

Unmetallic.
H. 1·0 . . . 2·5.
G. 1·9 . . . 2·01.

GENERAL PROPERTIES OF THE ORDERS OF CLASS III.

Order I. Resin. (M.)

H. 0·0 . . . 2·5.
G. 0·7 . . . 1·6.

Order II. Coal. (M.)

Streak brown, black.
H. 1·0 . . . 2·5.
G. 1·2 . . . 1·6.

GENERAL PROPERTIES OF THE GENERA OF CLASS I. *with an enumeration of the Species they contain.*

I. GAS.

Gen. I. Hydrogen Gas. (M.) Odor disagreeable.

Sp. 1. Pure (M.) *Hydrogen.*
2. Empyreumatic (M.) *Carburetted Hydrogen.*
3. Sulphuretted (M.) *Sulphuretted Hydrogen.*
4. Phosphuretted (M.) *Phosphuretted Hydrogen.*

Gen. II. Oxygen Gas. (S.)

Sp. 1. Pure (S.) *Oxygen.*

Gen. III. Nitrogen-Gas. (S.)

Sp. 1. Pure (S.) *Nitrogen.*

Gen. IV. Atmospheric-Gas. (M.)

Sp. 1. Pure (M.) *Atmospheric Air.*

II. WATER.

Gen. I. Atmospheric-Water. (M.)

Sp. 1. Pure (M.) *Water.*

III. ACID.

Gen. I. CARBONIC-ACID. (M.)

Sp. 1. Aeriform (M.) *Carbonic Acid.*

Gen. II. MURIATIC-ACID. (M.)

Sp. 1. Aeriform (M.) *Muriatic Acid.*

Gen. III. SULPHUROUS-ACID. (M.)

Sp. 1. Aeriform (M.) *Sulphurous Acid.*
2. Liquid (M.) *Sulphuric Acid.*

Gen. IV. BORACIC-ACID. (M.)

Sp. 1. Prismatic[6] (M.) *Sassolin.*

Gen. V. ARSENIC-ACID. (M.)

Sp. 1. Octahedral[7] (M.) *White Arsenic.*

IV. SALT.

Gen. I. NATRON-SALT. (M.) Taste pungent, alkaline. H. 1·0 ... 1·5. G. 1·4 ... 1·5.

Sp. 1. Peritomous[8] (S.) *Gay Lussite.*
2. Hemi-prismatic[9] (M.) *Natron.*
3. Tetarto-prismatic[10] (S.) *Trona.*

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[6] Applied to crystals derived from the right rhombic prism.

[7] Applied to crystals derived from the regular octahedron.

[8] Περι, *around*, and τεμνω, *I cleave*,—implying that the cleavage takes place in more than one direction parallel to the axis, and that the faces are all of the same quality. The result of the cleavage is a vertical prism.

[9] Ἡμι, *half*, applied to oblique rhombic prisms.

[10] Τέταρτος, *fourth*, applied to oblique rhombic prisms.

Gen. II. EARTHY-SALT. (S.) Deliquescent.

Sp. 1. Calcareous (S.) *Nitrocalcite.* (S.)
2. Magnesian (S.) *Nitro-Magnesite.* (S.)

Gen. III. GLAUBER-SALT. (M.) Taste cool, then saline and bitter: weak. H. 1·5...2·0. G. 1·4...1·5.

Sp. 1. Prismatic (M.) *Glauber-Salt.*
2. Prismatoidal[11] (S.) *Aphthitalite*[12] (BEU.)

Gen. IV. NITRE-SALT. (M.) Taste saline and cool. H. 2·0. G. 1·9...2·0.

Sp. 1. Prismatic (M.) *Nitre.*
2. Rhombohedral[13] (S.) *Soda Nitre.* (S.)

Gen. V. ROCK-SALT. (M.)

Sp. 1. Hexahedral[14] (M.) *Common Salt.*

Gen. VI. AMMONIA-SALT. (M.)

Sp. 1. Octahedral (M.) *Sal-Ammoniac.*

Gen. VII. VITRIOL-SALT. (M.) Taste astringent. H. 2·0 ...2·5. G. 1·8...2·3.

Sp. 1. Hemi-prismatic (M.) *Copperas.*
2. ———————— *White Copperas.*
3. Paratomous[15] (S.) *Botryogene.* (HAID.)
4. Tetarto-prismatic (M.) *Blue Vitriol.*

---

[11] Alluding to a single cleavage, parallel to the axis.

[12] Αφθιτος, *unalterable*, and αλς, *salt.*

[13] Implying the connexion of the forms with the rhomboid.

[14] Implying the connexion of the forms with the cube.

[15] Παρὰ, *about*, and τεμνω, *I cleave*, referring to faces of cleavage of an indeterminate number.

5. Prismatoidal (S.)	*Brochantite.* (Levy.)
6. Prismatic (M.)	*White Vitriol.*
7. Staphyline[16] (S.)	*Cobalt Vitriol.*
8. Habroneme[17] (S.)	*Uranium Vitriol.*

Gen. VIII. Uranium Salt. (S.)

Sp. 1. Cupric (S.)	*Johannite.*

Gen. IX. Bitter-Salt. (M.) Taste saline, bitter. H. 2·0...2·5. G. 1·7...1·8.

Sp. 1. Prismatic (M.)	*Epsom Salt.*
2. Volatile (S.)	*Mascagnine.* (Reuss.)

Gen. X. Alum-Salt. Taste sweetish, astringent. H. 2·0. 2·5. G. 1·7...1·8.

Sp. 1. Octahedral (M.)	*Alum.*
2. Prismatic (S.)	*Solfatarite.*[18] (S.)

Gen. XI. Borax-Salt. (M.)

Sp. 1. Prismatic (M.)	*Borax.*

Gen. XII. Brithyne[19]-Salt. (M.) Taste saline, feebly astringent. H. 2·5...3·0. G. 2·75...2·85.

Sp. 1. Peritomous (S.)	*Thénardite.*
2. Prismatic (M.)	*Glauberite.*
3. Stelene[20] (S.)	*Polyhallite.*

---

[16] Σταφυλή, *a bunch of grapes*, alluding to botryoidal shapes.

[17] Ἁβρὸς, *delicate*, and νῆμα, *a thread* or *fibre*.

[18] From the solfataras, in which the mineral is chiefly found.

[19] Βριθὺς, *dense*, (heavy.)

[20] Στήλη, *a column*, in allusion to the columnar structure of the mineral.

GENERAL PROPERTIES OF THE GENERA OF CLASS II.

HALOIDE.

Gen. I. CRYONE[21]-HALOIDE. (M.)

Sp. 1. Orthotypous[22] (M.) *Cryolite.*

Gen. II. ALUM-HALOIDE. (M.)

Sp. 1. Rhombohedral *Alum-Stone.*

Gen. III. MALACHITE-HALOIDE. (S.) Color green, or bluish green. H. 2·0...3·0. G. 2·3...3·0.

Sp. 1. Staphyline (S.) *Chrysocolla.*
2. Lirocone[23] (S.) *Liroconite.*
3. Hexahedral (S.) *Cube Ore.*
4. Prismatic (S.) *Skorodite.*
5. Habroneme (S.) *Nickel Green.*

Gen. IV. FLUOR-HALOIDE. (M.) H. 4·0...5·0. G. 3·0...3·3.

Sp. 1. Octahedral (M.) *Fluor.*
2. Rhombohedral (M.) *Apatite.*
3. Prismatic (S.) *Herderite.*
4. ———— *Fluellite.*
5. Hemi-prismatic (S.) *Yttrocerite.*

Gen. V. LIME-HALOIDE. (M.) H. 3·0...4·5. G. 2·5...3·2.

Sp. 1. Prismatic (M.) *Arragonite.*

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[21] Κρύος, *ice*, in allusion to the easy fusibility of the mineral.

[22] Ορθὸς, *straight*, and τυπος, *form*, in allusion to the perpendicular cleavage of the mineral.

[23] Λειρὸς, *pale*, and κονία, *powder*, or *dust*.

2. Rhombohedral (M.)	*Calcareous Spar.*
3. Macrotypous [24] (M.)	*Dolomite.*
4. Brachytypous [25] (M.)	*Rhomb Spar.*
5. Paratomous (M.)	*Ankerite.*
6. Microtine [26] (S.)	*Plumbocalcite.* (TURNER.)
7. Staphyline (S.)	*Magnesite.*

BARYTE.

Gen. I. PARACHROSE [27]-BARYTE. (M.) H. 3·5...6·0. G. 3·3...3·9.

Sp. 1. Macrotypous (M.)	*Diallogite.*
2. Brachytypous (M.)	*Spathic Iron.*
3. Rhombohedral (S.)	*Troostite.* (S.)
4. Prismatic (S.)	*Triplite.*
5. Tetarto-prismatic (S.)	*Manganese Spar.*
6. Staphyline (S.)	*Bustamite.*

Gen. II. ZINC-BARYTE. (M.) H. 5·0. G. 3·3...4 5.

Sp. 1. Prismatic (M.)	*Electric Calamine.*
2. Axotomous [28] (S.)	*Willemite.*
3. Rhombohedral (M.)	*Calamine.*

---

[24] Μακρὸς, *long*, and τυπος, *form*.

[25] Βραχὺς, *short*, and τυπος, *form*.

[26] Μικρὸς, *small*, alluding to the minuteness of the crystals.

[27] Παράκρωσις, *change of color*, from the alteration in color which the species undergo from exposure to the weather.

[28] Αξων, *the axis*, and τεμνω, *I cleave;* the cleavage consisting of a single face, which is perpendicular to the axis.

Gen. III. TUNGSTIC BARYTE. (M.) H. 4·0...5·5. G. 4·5...6·1.

Sp. 1.	Pyramidal[29] (M.)	*Tungsten.*
2.	Prismatic (S.)	*Xenotime.*[30] (BEU.)
3.	Octahedral (S.)	*Microlite.* (S.)
4.	Peritomous (S.)	*Thorite.*
5.	Rhombohedral (S.)	*Flucerine.*
6.	Tetarto-prismatic (S.)	*Monazite.* (B.)

Gen. IV. HAL-BARYTE. (M.) Prismatic and hemi-prismatic. H. 3·0...4·0. G. 3·6...4·7.

Sp. 1.	Peritomous (M.)	*Strontianite.*
2.	Hemi-prismatic (M.)	*Baryto-Calcite.*
3.	Di-prismatic[31] (M.)	*Witherite.*
4.	Prismatic (M.)	*Heavy Spar.*
5.	Prismatoïdal (M.)	*Celestine.*

Gen. V. LEAD-BARYTE. (M.) H. 2·5...4·0. G. 5·4...7·3.

Sp. 1.	Peritomous (M.)	*Kerasite.*
2.	Kerasine (S.)	*Corneous Lead.*
3.	Di-prismatic (M.)	*White Lead Ore.*

---

[29] Applied to crystals derived from the right square prism, and from the octahedron with a square base.

[30] Κενὸς, *vain*, and τιμὴ, *honor;* in allusion to the circumstance that the phosphate of yttria, of which this mineral consists, was for a time regarded as the oxide of a new metal, the Thorium.

[31] When the cleavages are parallel to the sides of a four-sided vertical prism, and at the same time to a horizontal prism.

4.	Hedyphanous (S.)	*Hedyphane.*
5.	Pyromorphous[33] (S.)	*Pyromorphite.*
6.	Staphyline (S.)	*Plumbo-Gummite.* (S.)
7.	Hemi-prismatic (M.)	*Red Lead-Ore.*
8.	Pyramidal (M.)	*Yellow Lead-Ore.* (S.)
9.	Tungstic (S.)	*Scheeletine.* (Beu.)
10.	Prismatic (M.)	*Anglesite.* (Beu.)
11.	Axotomous (M.)	*Leadhillite.* (Beu.)
12.	Prismatoidal (S.)	*Dyoxylite.*[34] (B.)
13.	Cupreous (S.)	*Caledonite.* (Beu.)
14.	Euotomous[35] (S.)	*Cupreous Anglesite.*
15.	————	*Vauquelinite.*

Gen. VI. Copper-Baryte. (S.) Color blue and green.
H. 2·5 . . . 5·0. G. 3·2 . . . 4·6.

Sp. 1.	Prismatic (S.)	*Olivinite.*
2.	Di-prismatic (S.)	*Libethenite.*
3.	Aphanistic[36] (S.)	*Aphanesite.*
4.	Azure (S.)	*Blue Malachite.*
5.	Rhombohedral (S.)	*Dioptase.*
6.	Peritomous (S.)	*Euchroite.*
7.	Hemi-prismatic (S.)	*Pseudo Malachite.*

---

[33] Πυρ, *fire*, and μορφὴ, *form*, referring to its crystallization from fire.

[34] Δὶς, *twice*, and ὀξὺς, *acid*, from its containing two acids.

[35] Ευ, *well*, and τέμνω, *I cleave*, from the distinctness of the cleavages.

[36] Αφανὴς, *indistinct.*

8. Habroneme (S.) *Green Malachite.*
9. Prismatoidal (S.) *Atacamite.*
10. Dystome[37] (S.) *Erinite.*

Gen. VII. TELLURIUM-BARYTE. (S.)

Sp. 1. Staphyline (S.) *Herrerite.*

Gen. VIII. BISMUTH-BARYTE. (S.)

Sp. 1. Tetrahedral (S.) *Bismuth-Blende.*

Gen. IX. ANTIMONY-BARYTE. (M.)

Sp. 1. Prismatic (M.) *White Antimony.*

KERATE.

Gen. I. PEARL KERATE. (M.) H. 1·0...2·0. G. 5·5...6·5.

Sp. 1. Hexahedral (M.) *Horn Silver.*
2. Pyramidal (M.) *Horn Quick Silver.*
3. Monotomous (S.) *Iodic Silver.*

MICA.

Gen. I. EUCHLORE[38]-MICA. (M.) Color green and yellow. H. 1·0...2·5. G. 2·5...3·2.

Sp. 1. Rhombohedral (M.) *Copper Mica.*
2. Prismatic (M.) *Kupaphrite.* (S.)
3. Pyramidal (M.) *Uranite.*

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[37] Δυς, *with difficulty*, and τέμνω, *I cleave.*

[38] Ευ, *well*, and χλωρὸς, *green*, from the distinctness of the green color.

Gen. II. COBALT-MICA. (M.)

Sp. 1. Diatomous[39] *Cobalt Bloom.*

Gen. III. Pyrosmalite-MICA. (B.)

Sp. 1. Hexagonal (B.) *Pyrosmalite.*

Gen. IV. IRON-MICA. (M.) H. 2·0...2·5. G. 2·6 ...2·7.

Sp. 1. Prismatic (M.) *Vivianite.*
2. Rhombohedral (S.) *Cronstedite.*

Gen. V. GRAPHITE-MICA. (M.)

Sp. 1. Rhombohedral (M.) *Plumbago.*

Gen. VI. TALC-MICA. (M.) H. 1·0...2·5. G. 2·4 ...3·0.

Sp. 1. Prismatic (M.) *Talc.*
2. Rhombohedral (M.) *Mica.*

Gen. VII. GYPSUM-MICA. (S.) H. 1·0...3·5. G. 2·3...3·0.

Sp. 1. Rhombohedral (S.) *Native Magnesia.*
2. Prismatoidal (S.) *Gypsum.*
3. Prismatic (S.) *Anhydrite.*
4. Diatomous (S.) *Haidingerite.*
5. Hemi-prismatic (S.) *Pharmacolite.*

Gen. VIII. PEARL-MICA. (M.)

Sp. 1. Rhombohedral (M.) *Margarite.*

---

[39] Διὰ, *through*, and τέμνω, *I cleave*,—implying that the crystals possess one distinct diagonal-cleavage.

PICROSMINE.

Gen. I. ATELENE[40]-PICROSMINE. (S.) Lustre dull. H. 2·5...3·0. G. 2·2...2·6.

Sp. 1.	Prismatic (S.)	*Serpentine.*
2.	Fibrous (S.)	*Picrolite.*
3.	Prismatoidal (S.)	*Picrosmine.*
4.	Nemaline[41] (S.)	*Nemalite.*
5.	Brittle (S.)	*Kerolite.*
6.	Glyptic (S.)	*Figure Stone.*

SPAR.

Gen. I. SCHILLER-SPAR. (M.) Cleavage monotomous. H. 3·5...5·0. G. 2·6...3·3.

Sp. 1.	Diatomous (M.)	*Schiller Spar.*
2.	Hemi-prismatic (M.)	*Bronzite.*

Gen. II. DISTHENE-SPAR. (M.) H. 5·0...7·0. G. 3·0...3·7.

Sp. 1.	Prismatic (M.)	*Kyanite.*
2.	Prismatoidal (S.)	*Spodumene.*

Gen. III. DYSTOME-SPAR. (M.) H. 5·0...7·0. G. 2·8...3·0.

Sp. 1.	Prismatic (M.)	*Datholite.*
2.	Pyramidal (S.)	*Gehlenite.*
3.	Periotomous (S.)	*Edingtonite.*

---

[40] Ατελής, *imperfect;* in allusion to the want of regular forms in the genus.

[41] Νῆμα, *a thread,*—from the fibrous structure.

Gen. IV. WAVELLINE-SPAR. (S.) Botryoidal, and columnar. H. 3·0...4·5. G. 1·85...3·00.

Sp. 1.	Staphyline (S.)	*Gibbsite.*
2.	Uncleavable (S.)	*Allophane.*
3.	Prismatic (S.)	*Wavellite.*
4.	Prismatoidal (S.)	*Karpholite.*
5.	Hemi-prismatic (S.)	*Cummingtonite.*
6.	Tetarto-prismatic (S.)	*Diaspore.*

Gen. V. KOUPHONE-SPAR. (M.) H. 3·5...6·0. G. 2·0...2·5.

Sp. 1.	Axotomous (M.)	*Prehnite.*
2.	Abrazitic[42] (S.)	*Gismondin.*
3.	Trapezohedral (S.)	*Leucite.*
4.	Dodecahedral (M.)	*Sodalite.*
5.	Hexahedral (M.)	*Analcime.*
6.	Paratomous (M.)	*Harmotome.*
7.	Vesuvian (S.)	*Comptonite.*
8.	Staurotypous[43] (M.)	*Phillipsite.*
9.	Rhombohedral (M.)	*Chabasie.*
10.	Sarcoline[44] (S.)	*Gmelinite.*
11.	Macrotypous (M.)	*Levyne.*
12.	Diatomous (M.)	*Laumonite.*
13.	Prismatic (M.)	*Mesotype.*
14.	Orthotomous (M.)	*Thomsonite.*
15.	Prismatoidal (M.)	*Stilbite.*

---

[42] A and Βράζω, *to bubble*, from the fact that it does not effervesce when melted before the blow-pipe.

[43] Σταυρὸς, *a cross*, and τύπος, *a form*, in allusion to the cross form of its macles.

[44] Σὰρξ, *flesh*, from its reddish white color.

16. Hemi-prismatic (M.) *Heulandite.*
17. Diplogenous (M.) *Epistilbite.*
18. Polyprismatic[45] (S.) *Brewsterite.*
19. Pyramidal (M.) *Apophyllite.*

Gen. VI. AZURE-SPAR. (M.) Color blue. H. 5·0... 6·0. G. 2·83...3·10.

Sp. 1. Prismatic (M.) *Lazulite.*
2. Prismatoidal (M.) *Blue Feldspar.*
3. Uncleavable (S.) *Turquoise.*

Gen. VII. FELD-SPAR. (M.) H. 5·0...6·0. G. 2·5 ...3·1.

Sp. 1. Rhombohedral (M.) *Nepheline.*
2. Orthotomous (M.) *Feldspar.*
3. Heterotomous[46] (M.) *Periklin.*
4. Tetarto-prismatic (M.) *Albite.*
5. Anorthotomous (M.) *Anorthite.*
6. Polychromatic[47] (M.) *Labradorite.*
7. Eruthrone[48] (S.) *Latrobite.*

Gen. VIII. ANDALUSITE-SPAR. (M.)

Sp. 1. Prismatic (M.) *Andalusite.*

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[45] Πολὺς, *many*, in allusion to the numerous prisms its crystals present in a single form.

[46] Ἕτερος, *another*, and τέμνω, *I cleave*, in allusion to its having a different cleavage from Feldspar.

[47] Πολὺς, *many*, and χρῶμα, *color*, in allusion to the play of colors it presents.

[48] Ἐρυθρὸς, *red.*

Gen. IX. PETALINE-SPAR. (M.) H. 5·0...6·5. G. 2·8...3·2.

Sp. 1.	Uncleavable (S.)	*Nephrite.*
2.	Dusclaone (S.)	*Saussurite.*
3.	Prismatic (M.)	*Petalite.*
4.	Rhombohedral (S.)	*Eudyalite.*
5.	Pyramidal (S.)	*Scapolite.*
6.	Peritomous (S.)	*Fahlunite.*
7.	Prismatoidal (S.)	*Amblygonite.*

Gen. X. AUGITE-SPAR. (M.) H. 4·5...7·0. G. 2·7...3·5.

Sp. 1.	Prismatoidal (M.)	*Epidote.*
2.	Dystome (H.)	*Bucklandite.*
3.	Paratomous (M.)	*Pyroxene.*
4.	Achmitic (S.)	*Achmite.*
5.	Axotomous (M.)	*Babingtonite.*
6.	Hemi-prismatic (M.)	*Hornblende.*
7.	Peritomous (M.)	*Arfwedsonite.*
8.	Metalloidal (S.)	*Hypersthene.*

Gen. XI. TABULAR-SPAR. (S.) H. 3·5...6·0. G. 2·0...2·9.

Sp. 1.	Tetarto-prismatic (S.)	*Tabular Spar.*
2.	Prismatic (S.)	*Pyrallolite.*
3.	Parachrose (S.)	*Boltonite.*

GEM.

Gen. 1. CORUNDUM. (M.) H. 7·0...9·0. G. 3·5...4·6.

Sp. 1.	Dodecahedral (M.)	*Spinel.*
2.	Octahedral (M.)	*Automolite.*
3.	Rhombohedral (M.)	*Corundum.*

Gen. II. DIAMOND. (M.)

Sp. 1. Octahedral (M.) *Diamond.*

Gen. III. TOPAZ. (M.)

Sp. 1. Prismatic (M.) *Topaz.*

Gen. IV. EMERALD. (M.) H. 7·5...8·0. G. 2·6...3·2.

Sp. 1. Prismatic (M.) *Euclase.*
2. Rhombohedral (M.) *Emerald.*
3. Pyramidal (S.) *Chrysoberyl.*
4. Phenakine (S.) *Phenakite.* (NORDENSKIÖLD.)

Gen. V. QUARTZ. (M.) H. 5·5...7·5. G. 1·9...2·7.

Sp. 1. Prismatic (M.) *Iolite.*
2. Rhombohedral (M.) *Quartz.*
3. Uncleavable (M.) *Opal.*
4. Empyrodox[49] (M.) *Pitchstone.*
5. Isopyric (H.) *Isopyre.*

Gen. VI. AXINITE. (M.) Color brown. H. 6·5...7·0. G. 3·0...3·3.

Sp. 1. Tetarto-prismatic (S.) *Axinite.*
2. Prismatoidal (S.) *Bucholzite.*

Gen. VII. CHRYSOLITE. (M.)

Sp. 1. Prismatic (M.) *Peridot.*

Gen. VIII. BORACITE.

Sp. 1. Tetrahedral (M.) *Boracite.*

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[49] Εμπυρὸς, *belonging to fire*, and δόξα, *opinion.*

Gen. IX. TOURMALINE. (M.) H. 7·0...7·5. G. 3·0 ...3·2.

Sp. 1. Rhombohedral (M.) *Tourmaline.*
2. Hemi-prismatic (S.) *Brucite.*
3. Pyramidal (S.) *Idocrase.*

Gen. X. GARNET. H. 6·0...7·5. G. 3·1...4·3.

Sp. 1. Tetrahedral (M.) *Helvin.*
2. Dodecahedral (M.) *Garnet.*
3. Pyramidal (M.) *Zircon.*
4. Prismatoidal (S.) *Staurotide.*

ORE.

Gen. I. MELANE[50]-ORE. (P.) H. 6·0...7·0. G. 4·0 ...4·3.

Sp. 1. Tetarto-prismatic (P.) *Allanite.*
2. Hemi-prismatic (P.) *Gadolinite.*

Gen. II. ERUTHRONE-ORE. (S.) Some shade of red or brown. H. 3·5...7·0. G. 3·4...7·1.

Sp. 1. Prismatic (S.) *Sphene.*
2. Pyramidal (S.) *Anatase.*
3. Prismtoidal (S.) *Aischynite.* (BERZ.)
4. Pyrochlore (S.) *Pyrochlore.*
5. Melanous (S.) *Polymignite.* (BERZ.)
6. Diatomous (S.) *Brookite.*
7. Peritomous (S.) *Rutile.*
8. Octahedral (S.) *Red Copper-Ore.*
9. Hemi-prismatic (S.) *Red Zinc-Ore.*

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[50] Μέλας, *Black.*

10.	Uncleavable (S.)	*Cerite.*
11.	Monotomous (S.)	*Yttro-Tantalite.*

Gen. III. IRON-ORE. (M.) H. 5·0...6.5. G. 3·8...5·3.

Sp. 1.	Octahedral (M.)	*Magnetic Iron.*
2.	Chromated (S.)	*Chrome-Ore.*
3.	Dodecahedral (M.)	*Franklinite.*
4.	Axotomous (M.)	*Crichtonite.*
5.	Uncleavable (S)	*Mohsite.*
6.	Rhombohedral (M.)	*Specular Iron.*
7.	Prismatic (M)	*Limonite.*
8.	Di-prismatic (M.)	*Yenite.*

Gen. IV. BARYTE-ORE. (S.) H. 5 0.., 6·0. G. 6·0 ...7·4.

Sp. 1.	Peritomous (S.)	*Tin-Ore.*
2.	Prismatic (S)	*Wolfram.*
3.	Pyramidal (S.)	*Columbite.*
4.	Uncleavable (S.)	*Pitchblende.*

Gen. V. MANGANESE-ORE. (M.) Color black. H. 2·0 ...6 5. G. 3 1...4 9.

Sp. 1.	Pyramidal (M)	*Black Manganese.*
2.	Brachytipous (M)	*Braunite.*
3.	Uncleavable (M)	*Psilomelane.*
4.	Prismatoidal (M.)	*Manganite.*
5.	Prismatic (M)	*Pyrolusite.*
6.	Staphyline (S.)	*Cupreous Manganese.*

Gen. VI. LUSINE[51]-ORE. (S.) Pulverulent.

Sp. 1. Bismuthic (S.)	*Bismuth Ochre.*
2. Tungstic (S.)	*Tungstic Ochre.*
3. Molybdic (S.)	*Molybdic-Ochre.*
4. Uranic (S.)	*Uranic-Ochre.*
5. Chromic (S.)	*Chrome-Ochre.*
6. Cobaltic (S.)	*Earthy Cobalt.*
7. Cupric (S.)	*Melaconite.*[52] (BEU.)
8. Plumbic (S.)	*Minium.*
9. Antimonic (S.)	*Antimony-Ochre.*

METAL.

Gen. I. MALACONE[53]-METAL. (S.) Color white, reddish and yellow. H. 0·0...3·5. G. 6·0...14·8.

Sp. 1. Auro-tellurium (S.)	*Mullerite.*[54] (BEU.)
2. Tellurium (S.)	*Native Tellurium.*
3. Bismuth (S)	*Native Bismuth.*
4. Mercury (S)	*Native Mercury.*
5. Argento-mercury (S)	*Native Amalgam.*
6. Argento-antimony (S)	*Antimonial Silver.*
7. Silver (S)	*Native Silver.*
8. Copper (S.)	*Native Copper.*
9. Gold (S.)	*Native Gold.*
10. Arsenic (S.)	*Native Arsenic.*
11. Antimony (S.)	*Native Antimony.*

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[51] Λύσις, *decomposition*, from the circumstance that the species of this genus result from the decomposition of other species.

[52] Μέλας, *black*, and κονία, *powder*.

[53] Μαλακὸς, *soft*.

[54] The discoverer's name.

Genus II. SCLERONE[55] METAL. (S.) H. 4·0 ... 5·0. G. 7·31 ... 18·5.

Sp. 1. Iron (S.)	*Native Iron.*
2. Platina (S.)	*Native Platina.*
3. Iridium (S.)	*Native Iridium.*
4. Irid-osmium (S.)	*Irid-Osmine.*
5. Palladium (S.)	*Native Palladium.*

PYRITES.

Gen. I. ERUTHLEUCONE[56]-PYRITES. (S.) Color white to red. H. 5·0 ... 6·0. G. 5·7 ... 7·0.

Sp. 1. Cupreous (S.)	*Copper Nickel.*
2. Euotomous (S.)	*Nickel Glance.*
3. Antimonial (S.)	*Nickel Stibine.* (BEU.)
4. Axotomous (S.)	*Leucopyrite.*[57] (S.)
5. Prismatic (S.)	*Mispickel.*
6. Cobaltic (S.)	*Cobalt Pyrites.*
7. Octahedral (S.)	*Smaltine.* (BEU.)
8. Hexahedral (S.)	*Cobaltine.* (BEU.)

Gen. II. CHLORONE[58]-PYRITES. (S.) Color greenish yellow. H. 3·0 ... 6·5. G. 4·1 ... 5·1.

Sp. 1. Hexahedral (S.)	*Iron Pyrites.*
2. Pyramidal (S.)	*Yellow Copper Pyrites.*
3. Prismatic (S.)	*White Iron-Pyrites.*
4. Capillary (S.)	*Capillary Pyrites.*

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[55] Σκληρὸς, *hard.*

[56] Ερυθρὸς, *red*, and λευκὸς, *white*, the color being a mixture of red and white.

[57] Λευκὸς, *white*, and πυριτης, *a stone emitting fire.*

[58] Χλωρὸς, *yellowish green.*

Gen. III. BRONZE-PYRITES. (S.) Color bronze. H. 3·5. ...4·0. G. 4·1...4·7.

Sp. 1. Rhombohedral (S.) *Magnetic Iron Pyrites.*
2. Octahedral (S.) *Variegated Copper.*

GLANCE.

Gen. 1. COPPER-GLANCE. (M.) H. 2·5...4·0. G. 4·3...5·8.

Sp. 1. Hexahedral (M.) *Tin Pyrites.*
2. Tetrahedral (M.) *Fahlerz.*
3. Di-prismatic (M.) *Bournonite.*
4. Prismatic (M.) *Vitreous Copper.*

Gen. II. POLYPOIONE[59]-GLANCE. (S.) H. 1·0...2·5. G. 4·5...8·5.

Sp. 1. Prismatoidal (S.) *Black Silver.*
2. Dodecahedral (S.) *Vitreous Silver.*
3. Hexahedral (S.) *Galena.*
4. Selenious (S.) *Eukairite.*
5. Paratomous (S.) *Clausthalite.*[60] (BEU.)
6. Prismatic (S.) *Black Tellurium.*
7. Telluric (S.) *Telluric Silver.*
8. Bismuthic (S.) *Bornite.*[61] (BEU.)
9. Uncleavable (S.) *Stromeyerite.*
10. Cupreous (S.) *Cupreous Bismuth.*
11. Monotomous (S.) *Sternbergite.*

---

[59] Πολὺς, *many*, and ποίεω, *to make*, in allusion to the number of species in the genus.

[60] From the locality.

[61] Named from DE BORN.

12. Rhombohedral (S.) *Molybdenite.*
13. Axotomous (S.) *Polybasite.*[62]

Gen. III. ANTIMONY-GLANCE. (M.) H. 1·5 ... 2·5.
G. 4·2 ... 5·8.

Sp. 1. Prismatic (M.) *Graphic Gold.*
2. Prismatoidal (M.) *Grey Antimony.*
3. Axotomous (M.) *Jamesonite.*
4. Peritomous (P.) *Zinkenite.*[63]

BLENDE.

Gen. I. SCLERONE-BLENDE. (S.) H. 3·5 ... 4·0.
G. 3·9 ... 4·2.

Sp. 1. Hexahedral (S.) *Manganblende.*
2. Dodecahedral (S.) *Blende.*

Gen. II. MALACONE-BLENDE. (S.) H. 1·0 ... 2·5.
G. 4·5 ... 8·2.

Sp. 1. Prismatic (S.) *Red Antimony.*
2. Rhombohedral (S.) *Red Silver.*
3. Aphotistic[64] (S.) *Proustite.* (BEU.)
4. Hemi-prismatic (S.) *Myargyrite.*
5. Peritomous (S.) *Cinnabar.*
6. Selenious (S.) *Rionite.*[65] (S.)
7. Yellow (S.) *Orpiment.*
8. Red (S.) *Realgar.*

---

[62] Πολὺς, *many*, and Βάσις, *base*, having many bases in its composition.

[63] Named from ZINKEN, its discoverer.

[64] A and φως, *void of light*, from its dark color.

[65] Named from DEL RIO.

SULPHUR.

Gen. I. BRITTLE SULPHUR. (S.)

Sp. 1. Prismatic (S.) *Sulphur.*
2. Selenious (S.) *Sulpho-Selenite.* (S.)

GENERAL PROPERTIES OF THE GENERA IN CLASS III.

RESIN.

Gen. I. MELICHRONE[66]-RESIN. (M.)

Sp. 1. Pyramidal (M.) *Mellite.*

Gen. II. MINERAL RESIN. (M.) H. 0·0 ... 2·5. G. 0·8 ... 1·2.

Sp. 1. Yellow (M.) *Amber.*
Black (M.) *Bitumen.*

COAL.

Gen. I. MINERAL-COAL. (M.) H. 1·0.

Sp. 1. Bituminous (M.) *Bituminous Coal.*
2. Non-bituminous (M.) *Anthracite.*

---

[66] Μελιχρων, *having the color of honey.*

GENERAL DESCRIPTIONS

OF THE

SPECIES.

ABRAZITE. (See *Gismondin.*)

ACHMITE. Achmitic Augite-Spar.

Primary form. Oblique rhombic prism. M on M = 93° 4′.

Secondary form. The primary, having the obtuse lateral edges deeply truncated, together with the edges of the base in such a manner as to give rise to a very acute 4-sided summit: the acute lateral edges also slightly truncated in some instances.

Cleavage, parallel with M distinct; traces, parallel with the diagonals. Fracture imperfectly conchoidal. Surface, broad secondary lateral planes streaked longitudinally; the rest, smooth and shining.

Lustre vitreous. Color brownish-black, with a tinge of yellow or green. Streak pale yellowish-grey. Translucent on the edges, to opake.

Brittle. Hardness = 6·0...6·5. Sp. gr. = 3·2...3·3.

1. Before the blow-pipe it melts into a black globule, which moves the magnetic needle. It affords no moisture by calcination, and is not attacked by the acids.

2. *Analysis.*

By BERZELIUS.

Silica	55·25
Peroxide of iron	31·25
Soda	10·40
Lime	0.72
Protoxide of manganese,	1·08

3. It is found engaged in Quartz near Kongsberg in Norway.

4. This mineral has been referred to Pyroxene by several mineralogists, from which substance, however, it appears sufficiently distinct.

ACHYRITE. (See *Dioptase.*)

ACICULAR BISMUTH GLANCE. (See *Needle-Ore.*)

ACTINOTE. (See *Hornblende.*)

ACTYNOLITE. (See *Hornblende.*)

ADAMANTINE-SPAR. (See *Corundum.*)

ADINOLE. (See *Petrosilex.*)

ADIPOCIRE MINERAL. (See *Hatchetine.*)

ADULARIA.

The most transparent and pure varieties of *Albite* and *Feldspar*, q. v.

AEQUINOLITE. (See *Pitchstone.*)

AEROSITE. (See *Red Silver.*)

AGALMATOLITE. (See *Figure-stone.*)

AGARIC MINERAL. (See *Calcareous Spar.*)

AGATE. (See *Quartz.*)

AISCHYNITE. Prismatoidal Eruthrone-Ore.

Primary form. Rigbt rhombic prism.

Secondary form. The primary, terminated by 4-sided pyramids.

Lustre sub-metallic. Color black. Streak dark grey to black.

Hardness =5·0...7·0. Sp. gr. =5·14...5·55.

1. In the matrass, it yields a little moisture, without altering its appearance. In an open tube it affords distinct traces of Fluoric acid. At an incipient red heat, upon charcoal, or in the platina forceps, it puffs up and enlarges in all its dimensions, especially in the direction of its cleavage, curls over to one side and remains without fusing of a dull yellow color. With borax, it is dissolved in large quantities; the glass presenting a dark yellow color both in the oxidation and reduction fire of the blow-pipe. When the mineral is added in excess, the glass after cool-

ing becomes opake. It is easily soluble into a clear and colorless glass with the salt of phosphorus. With soda, it is decomposed, without suffering fusion.

2. *Analysis.*

By HARTWALL.

Titanic acid	56·00
Zirconia	20·00
Oxide of cerium	15·60
Lime	3·80
Oxide of iron	2·60
Oxide of tin	0·50

3. It was brought from Mias in the Ural mountains of Siberia, by MENGE.

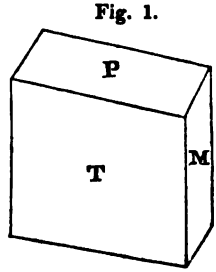
ALBIN. (See *Apophyllite.*)

ALBITE. Tetarto-prismatic Feldspar.

PARTSCH.

Primary form. Doubly oblique prism.

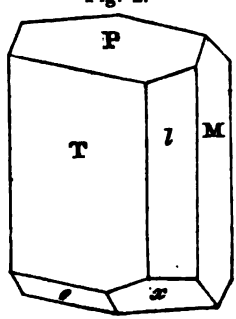
Fig. 1.



M on T	117°	53′
M on P	93	30
T on P	115	5

Secondary form.

Fig. 2.



M on *l*	119°	52′
P on *l*	119	51
P on *x*	127	23
T on *x*	110	29

Albite.

Cleavage, parallel to P perfect; parallel to the faces M and T less perfect, though frequently obtained with sufficient precision to admit of the application of the reflective goniometer.

Fracture uneven, imperfectly conchoidal.

Surface slightly rough or streaked upon some of the primary faces, but even.

Lustre vitreous, often inclining to pearly upon perfect faces of cleavage. Color white, passing into grey, red and green. Streak white. Transparent in small crystals,... translucent on the edges. A bluish opalescence is sometimes observable.

Brittle. Hardness = 2·613 (small transparent crystals from Dauphiny.) Limits 2·61 ... 2·68.

Compound varieties. Twin-crystals. Axis of revolution perpendicular to the prismatic axis.

Fig. 3.

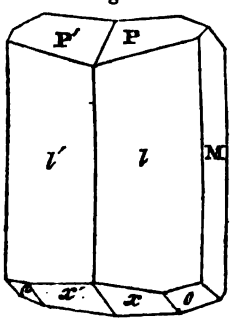
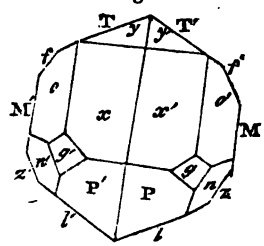


Fig. 4.



M on *g* - - - - - - - -	100	52
M on *z* - - - - - - - -	149	12
M' on *f* - - - - - - - -	148	30
P on *g* - - - - - - - -	150	5
P on *y* - - - - - - - -	97	37
T on *y* - - - - - - - -	134	32

Albite.

Twin-crystals, like the above figures, and others still more complicated, are of frequent occurrence, compared with simple forms.

Massive: composition granular; individuals of various sizes, commonly compressed parallel to T, in which case the composition assumes a lamellar appearance; the lamellæ being arranged somewhat in a stellular manner. The composition rarely approaches the impalpable, in which case it becomes strongly coherent.

1. Before the blow-pipe on charcoal, it becomes glassy, semi-transparent and white; but melts with difficulty only on its edges into a semi-transparent, vesicular glass. It is dissolved by borax, but slowly and without effervescence. If the borax be previously mingled with oxide of nickel, the resulting globule will present a brown color.

2. *Analysis.*

	By Eggertz, from Finbo.	By Rose, from Arendal.	By Stromeyer, from Chesterfield, Mass.
Silica	70·48	68·84	70·68
Alumina	18·45	20·53	19·80
		With a little oxide of iron and lime.	
Soda	10·50	9·12	9·06
Lime	·55	0·00	0·23
Oxide of iron & manganese	0·00	0 00	1·11

3. Albite is found entering into the composition of granite, either along with quartz and mica, or accompanied by feldspar. In general, it would appear, that in those granite veins and beds, where Tourmaline abounds, Albite is substituted for feldspar. Albite is also one of the constituents of sienite and greenstone.

4. The largest crystals of Albite hitherto known, are from Kerabinsk in Siberia. Crystallized varieties are found also in the highest districts of St. Gothard, and the Alps of Savoy. The foliated, massive, and nearly impalpable varieties, occur at Chesterfield and Goshen, (Mass.) associated with Tourmalines of various colors, as also at Paris in Maine; at the former places, small transparent crystals, lining cavities in the massive variety, rarely present themselves: in Middletown, Con., at Had-

dam, Con., in two different localities; the one along with Chrysoberyl and Columbite, where it is almost impalpably massive; the other, one mile and a half S.W., where it occurs in large granular individuals of a greenish white color, associated with Quartz, black Tourmaline, and rarely with the variety of mica called Pinite. A variety similar to that occurring along with the Columbite of Haddam, comes from Finbo and Brodbo in Sweden.

ALLAGITE. (See *Red Manganese-Ore.*)

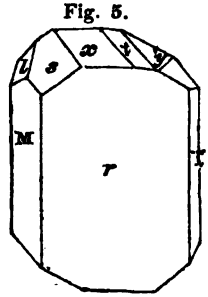
ALLANITE. Tetarto-Prismatic Melane-Ore. PARTSCH.

Primary form. Right oblique-angled prism. M on T =115°.

Secondary form.

M on *r*	- - - - - -	116°	00′
T on *r*	- - - - - -	129	00
s on *r*	- - - - - -	135	30
y on *r*	- - - - - -	109	01
s on *x*	- - - - - -	156	45
t on *x*	- - - - - -	164	30
y on *x*	- - - - - -	151	00
y on *t*	- - - - - -	166	30

Fig. 5.



Cleavage, parallel to *r* and M distinct. Fracture imperfectly conchoidal.

Lustre imperfectly metallic to resinous. Color brownish or greenish-black. Streak greenish-grey. Opake. Faintly translucent and brown in thin splinters, to opake.

Brittle. Hardness=6·0. Sp. gr.=4·001.

Compound varieties. In acicular aggregations. Massive. Composition impalpable. Lustre vitreous. Color passing into brown if the mineral be decomposed. Sp. gr. =3·1....4·0.

Allanite.

1. Several minerals, proposed by different authors as distinct, appear to fall within the present description. Of these the *Allanite* of THOMSON presents us with the most distinct crystals. The *Orthite* of BERZELIUS owes its diminished sp. gr. to its state of partial decomposition. The *Cerine* of the same author, or the *Cerium oxidé siliceux noir* of HAÜY, is usually compact and black.

2. Allanite froths before the blow-pipe, and melts imperfectly into a black scoria, and it gelatinizes in nitric acid. Orthite froths, becomes yellowish brown, and melts with effervescence into a black vesicular globule; with borax into a transparent one, and gelatinizes in heated acids. The Cerine behaves in a similar manner, but its globule acts upon the magnetic needle.

3. *Analysis.*

	By THOMSON,	By BERZELIUS,	
	Allanite, from Greenland.	*Orthite*, from Finbo.	from Gottliebsgang.
Oxide of cerium	33·90	17·39	19·44
Oxide of iron	25·40	11·42	12·44
Silica	35·40	18·83	32·00
Lime	9·20	4·89	7·84
Alumina	4·10	14·00	14·80
Yttria	00·00	3·80	3·44
Oxide of manganese	00·00	1·36	3.40
Water	00·00	3·70	5·36

	By WOLLASTON.	By HISINGER.
	Allanite, from Mysore.	*Cerine*, from Riddarhytta.
Silica	34·00	30·17
Alumina	9·00	11·31
Oxide of cerium	19·80	28·19
Oxide of iron	32·00	20·72
Lime	00·00	9.12
Oxide of copper	00·00	0·89
Water	00·00	0·40

4. Allanite was first found at Alluk in East Greenland, accompanied by Zircon and Quartz. Orthite occurs at Finbo, near Fahlun in Sweden, along with Quartz, Feldspar and Albite, in gneiss. The Cerine exists in the copper mines of St. Görans at Riddarhytta.

ALLOCHROITE. (See *Garnet*.)

ALLOPHANE. Uncleavable Wavelline-Spar

Reniform, botryoidal, massive; composition impalpable. Fracture conchoidal.

Lustre vitreous, inclining to resinous. Color blue, green, brown and grey. Transparent . . . translucent on the edges.

Hardness = 3·0 nearly. Sp. gr. = 1·85 . . . 1·88.

1. Alone upon charcoal before the blow-pipe, it does not melt, though it swells up, becomes feebly coherent, and communicates to the flame a copper green color. With borax, it fuses with great difficulty into a colorless glass. It is not soluble in soda; but the mass becomes green in the oxidation heat, and red in the reduction flame: on the addition of borax, a speck of metallic copper may be obtained.

2. *Analysis.*

	By Stromeyer, from Saalfeld.		By Ficinus, from Schneeberg.
Alumina	32.202	Hydrate of alumina	34·80
Silica	21·922	Silica	30·
Lime	0·730	Hydrate of copper	23·70
Sulphate of lime	0·517	Carbonate of lime	2·80
Carbonate of copper	3·058	Oxide of manganese	1·90
Hydrate of iron	2·270	Water	7.80
Water	41·301		

3. It is found at Saalfeld in Thuringia, Schneeberg in Saxony, and at Taune in the Hartz.

Almandin. (See *Garnet.*)

ALUM. Octahedral Alum-Salt. Mohs.

Stalactitic: composition columnar or granular, often impalpable. Mealy efflorescence.

Lustre vitreous; if delicately fibrous, pearly; sometimes dull. Color white or greyish white. Transparent . . . translucent or opake.

Hardness = 2·0 . . . 2·5. Sp. gr. = 1·75. Taste sweetish astringent.

Alum—Alum-stone.

1. Alum is very soluble in water, melts before the blow-pipe in its water of crystallization, and is converted into a spongiform mass.

2. *Analysis.*

Potash	9·94
Alumina	10·82
Sulphuric acid	33·77
Water	45·47

3. It occurs in a state of efflorescence upon minerals and rocks which contain alumina, potash and sulphuret of iron; as upon alum-stone, alum-slate and mica-slate: it is also found accompanying brown-coal, and is contained in the waters of certain mineral springs.

4. Alum occurs on the alum-slate rocks near Christiania in Norway, and under the same circumstances as near Moffat in Dumfries-shire, and Ferry-town of Cree in Galloway; on bituminous shale and slate-clay at Hurlet near Paisley in Scotland: in coal mines in Bohemia, Bavaria and Italy; and in various places, too numerous to be mentioned, in New-England, upon mica-slate.

5. This salt, as produced by nature, requires first to be purified, in order to be fitted for the purposes of the arts. Its artificial solution affords it in regular crystals, having the form of the regular octahedron. A great quantity of alum is obtained by the aid of chemical processes. Its uses are various; as for instance, in dyeing, in medicine, for the manufacture of leather and paper, and the prevention of putrefaction.

ALUMINITE. (See *Websterite.*)

ALUM-STONE. Rhombohedral Alum-Haloide. MOHS.

Primary form. Rhomboid. P on P 92° 50′ r. g.

Secondary form. The primary form with one or more of its lateral solid angles replaced by tangent planes.

Cleavage parallel with the tangent secondary planes rather perfect, that parallel with the primary faces indistinct. The primary faces sometimes streaked parallel to the edges of the secondary faces.

Lustre vitreous, inclining to pearly upon the more distinct faces of cleavage. Color white, sometimes reddish or greyish. Streak white. Transparent . . . translucent.

Brittle. Hardness =5·0. Sp. gr. =2·694 (a crystallized variety from Tolfa.)

Compound Varieties. Massive: composition small granular, often impalpable; fracture uneven, flat conchoidal, splintery, sometimes earthy.

1. Alone, in the matrass, before the blow-pipe, it at first disengages moisture; but a more intense heat occasions a sublimate of sulphate of ammonia. The crystals decrepitate with great energy when heated, and become reduced to powder like Diaspore. Upon charcoal in a strong heat it contracts, but does not melt. It dissolves however, in borax, with effervescence, and gives rise to a colorless and transparent glass.

2. *Analysis.*

	By Vauquelin.	By Cordier, of the crystals.
Alumina	48·92	39·654
Silica	24·00	0·000
Sulphuric acid	25·00	35·495
Potash	3·08	10·021
Water	4·00	and loss 14·330
		a trace of oxide of iron.

3. Alum-stone is found at Tolfa near Civita Vecchia, in the vicinity of Rome; also in Tuscany in the kingdom of Naples, and in the county of Beregh in Hungary. According to Cordier, it exists in almost all burning volcanoes. It seems to form beds of greater or less extent, chiefly made up of the massive varieties, in which small cavities occasionally present themselves lined with the crystals, which are always very minute.

4. It is employed in the manufacture of alum; and the superior quality of that from Tolfa has been ascribed to this mineral.

Amalgam. (See *Native Amalgam.*)

Amazon stone. (See *Feldspar.*)

Amausite. (See *Petrosilex.*)

AMBER. Yellow Mineral-Resin. Mohs.

Irregular forms, grains and spheroidal masses.

Amber.

Cleavage none. Fracture conchoidal. Surface uneven and rough.

Lustre resinous. Prevalent color yellow, passing into red, brown and white. Streak white. Transparent... translucent.

Not very brittle. Hardness = 2·0...2·5. Sp. gr. = 1·081.

Resinous electricity produced by friction.

1. Two sub-species have been distinguished in Amber, according to their lustre and transparency. *Yellow* Amber contains yellow and red varieties, and which possess the highest degrees of transparency to be met with in the species. *White* Amber refers to white and pale yellow, faintly translucent varieties. Often, however, both kinds are joined in one and the same specimens,—passing insensibly into each other, which demonstrates their identity.

2. Amber burns with a yellow flame, giving out an agreeable odor, and leaves a carbonaceous residue. It is soluble in alcohol.

3. *Analysis.*

By Drappier.

Carbon	80·59
Hydrogen	7·31
Oxygen	6·73
Lime	1·54
Alumina	1·10
Silica	0·63

4. Amber, without doubt owes its origin to the vegetable kingdom; an opinion sufficiently established by the insects and other organic bodies which it often includes, by the analogous substance known in commerce under the name of Gum Copal, which is afforded by a family of trees growing in India, as well as by the circumstances under which Amber is known to occur,—it being found in beds of bituminous wood, from which it is disengaged by the action of the waves on the sea coast.

5. The principal places from whence Amber is obtained are: the Prussian borders of the Baltic Sea, (where it is collected by the government, either during or immediately after storms, which rake it up from its bed and throw it on shore,) Denmark, Spain, Sicily, Greenland, Chi-

na and other countries. It has repeatedly been met with in various parts of the Green sand formation of the United States, either loose in the soil, or engaged in marl or lignite, as at Gay Head on Martha's Vineyard, near Trenton in New Jersey, at Camden in Pennsylvania, and at Cape Sable (near Magothy river) in Maryland.

6. The more transparent and handsomely colored specimens are cut into various ornaments and works of art; more common varieties are employed in the formation of certain kinds of varnish. It is also used for fumigation. The oil and acid of amber were formerly articles of medicine.

AMBLYGONITE. Prismatoidal Petaline-Spar.

Primary form. Oblique rhombic prism. M on M′ = 106° 10′.

Cleavage parallel to the prismatic faces, apparently with greater facility in one direction than in the other. Fracture uneven.

Lustre vitreous, inclining to pearly. Color greenish-white, passing into light mountain and celandine-green. Streak white. Semi-transparent . . . translucent.

Hardness = 6·0. Sp. gr. = 3·00 . . . 3·04.

Compound Varieties. Massive: composition columnar.

1. Heated by itself in a matrass, it affords a little moisture, which in a high heat is perceptibly acid, and corrodes the glass. Upon charcoal, before the blow-pipe, it easily melts into a clear glass, which however becomes opake on being suffered to cool.

2. *Analysis.*
By Berzelius.

Phosphoric acid	54·12
Alumina	38·96
Yttria	6·92

3. It is found only at Chursdorf near Penig in Saxony, where it occurs in granite along with Tourmaline and Topaz.

Amethyst. (See *Quartz.*)

Analcime.

Amianthus.

Silky fibrous varieties of *Hornblende*, *Pyroxene*, *Picrosmene* and *Nemolite*. q. v.

Amphibole. (See *Hornblende*.)

Amphige'ne. (See *Leucite*.)

Amphodellite.

Crystalline; the form of the crystals said to resemble those of Feldspar. Cleaves in two directions, whose mutual inclination is 94° 9′.

Fracture resembles that of Scapolite. Color reddish.

Hardness = 4·5. Sp. gr. = 2·793.

1. *Analysis.*

By Nordenskold.

Silica	45·80
Alumina	35·45
Lime	10·15
Magnesia	5·05
Protoxide of iron	1·70
Moisture and loss	1·85

2. It is found in the lime quarries of Lozo in Finland.

3. There does not appear to be any sufficient reason why Amphodellite should not be included under Scapolite, except the indications of crystalline form, which however do not appear to have received much attention.

ANALCIME. Hexahedral Kouphone-Spar. Mohs.

Primary form. Cube.

Secondary forms.

Fig. 6.

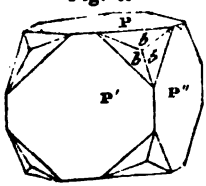
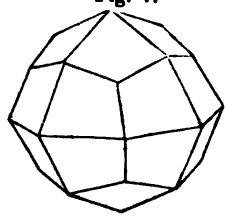


Fig. 7.



P, P′ or P″ on *b* - - - -	144°	44′	8″
b on *b* - - - -	146	26	33

Analcime.

Cleavage parallel with the primary form obtained with difficulty; and even when most distinct, of a very interrupted appearance.

Fracture, imperfectly conchoidal, uneven.

Surface in general smooth, sometimes faintly streaked.

Lustre vitreous. Color white, passing into grey, more frequently into reddish-white and flesh-red. Streak white transparent . . . translucent.

Brittle. Hardness = 5·5. Sp. gr. = 2·068 (crystals from the Tyrol.)

Compound Varieties. Massive: composition granular, of various sizes of individuals, more or less strongly coherent. Faces of composition uneven and rough, and often irregularly streaked.

1. When first heated, Analcime becomes milk-white, and affords a little moisture: in a more intense heat upon charcoal, it melts without intumescence or ebullition into a clear, slightly vesicular, glassy globule. It gelatinizes in muriatic acid.

2. *Analysis.*
By Berzelius.

Silica	55·84
Alumina	22·55
Soda	13·73
Water	7·90

3. Analcime chiefly belongs to trap and basalt, in the amygdaloidal varieties of which it mostly abounds. It has also been found, but more rarely, in lavas and in gneiss. Associated with it, are Calcareous spar and the zeolitic minerals, particularly Chabasie and Mesotype. When found in gneiss, it has occurred in beds, or metalliferous veins, along with Garnet and Pyroxene.

4. Large and handsome crystals of Analcime are found at the Seiser Alp in the Tyrol, at Dumbarton in Scotland, near Almas and Tökörö in Transylvania. Other localities are, the western isles of Scotland, Faroe Islands and Iceland, Partridge Island in the Basin of Mines, (Nova Sco-

tia,) and Monte Somma—where from its being of a flesh-red color it has received the name of *Sarcolite*. It is met with in the iron-stone beds of Arendal in Norway, and in the silver veins of Andreasberg in the Hartz.

ANATASE. Pyramidal Titanium-Ore. Mohs.

Primary form. Octahedron with a square base. P on P (over the base) =136° 47′.

Secondary forms.

Fig. 8.

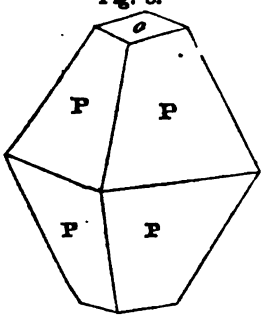
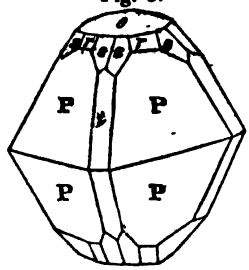


Fig. 9.



P on *o*	-	-	-	-	111°	17′
r on *o*	-	-	-	-	152	27
r on *s*	-	-	-	-	166	30
P on *s*	-	-	-	-	132	5

Cleavage parallel to the primary faces and to *o*, both perfect.

Fracture conchoidal, scarcely observable.

Surface smooth and shining.

Lustre metallic adamantine. Color various shades of brown, more or less dark, also indigo-blue. Streak white. Semi-transparent . . . translucent.

Hardness = 5·5 . . . 6·0. Sp. gr. = 3·826.

1. Before the blow-pipe, it behaves like pure oxide of titanium. It dissolves, with difficulty, in the salt of phosphorus, and the portion not melted becomes white and semi-transparent. The experiments of VAUQUELIN prove it to be a pure oxide of titanium.

2. It occurs in narrow, irregular veins, consisting of those species which constitute the rocks themselves, viz. Albite, Quartz, Mica and Augite, and is sometimes accompanied by Axinite and Crichtonite.

Its chief localities are Bourg d'Osians, in Dauphiny and Switzerland; but it is also found in Cornwall, in Norway, in Spain and Brazil.

ANDALUSITE. Prismatic Andalusite. MOHS.

Primary form. Right rhombic prism. M on M′ = 91° 20′

Secondary forms.

Fig. 10.

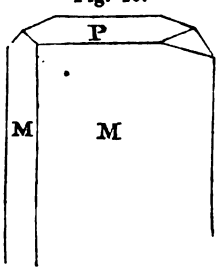
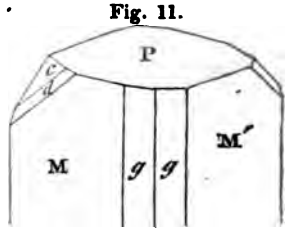


Fig. 11.



M on M′	-	-	-	91°	20′
P on M′ or M	-	-	-	90	00
P on *c*	-	-	-	140	00
d on *c*	-	-	-	145	00
g on *g*	-	-	-	125	00

Cleavage, parallel with M and M′ distinct; parallel with P scarcely perceptible.

Fracture uneven.

Surface uneven and rough. Generally covered with plates of Mica or Talc.

Lustre vitreous. Color flesh-red passing into pearl-grey. Streak white. Translucent on the edges.

Andalusite.

Hardness = 7·5. Sp. gr. = 3·104 (of a cleavable variety.)

Compound varieties. Massive: composition indistinctly granular and columnar.

1. The mineral long known under the name of *Macle* or *Chiastolite* appears to be a mixed mineral, consisting of Andalusite and some of the minerals entering into the formation of clay slate; the Andalusite assuming a crystalline form and being subject to a remarkable composition, which will be understood from the annexed figures representing cross sections of the twin-crystals. The twin crystal in each instance, it will be seen, results from the juxta-position of four single crystals, whose nearest point of contact, as respects any two of them, is formed by

Fig. 12.

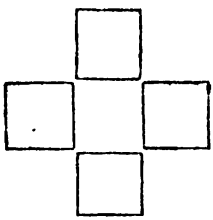


Fig. 13.

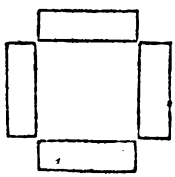
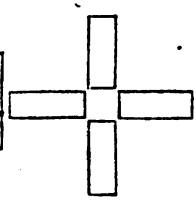


Fig. 14.



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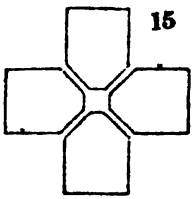

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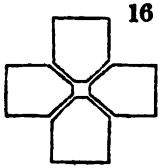

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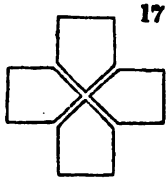

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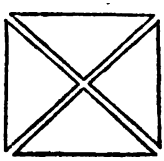

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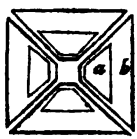

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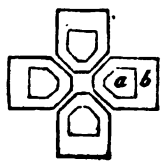


Andalusite.

their lateral edges. It is not common to find the edges of the bases equal, as in fig. 12; two of the sides being more frequently unduly extended, as in figs. 13 and 14. Cross-sections made in different parts of one crystal sometimes afford the different appearances of figs. 12, 13, and 14. But the more common mode of aggregation is represented by figs. 15, 16, 17 and 18, which results from the greater or less replacement of the angles that are adjacent in the composition. Rarely, we are presented with a parti-colored aspect, as in figs. 19 and 20, the inner portion *a* exhibiting a milk-white color, while the exterior *b*, is of a greenish grey color. The hardness of these crystals varies from 3·0 to 7·5, according to the preponderance of Andalusite in their composition. Those which possess the hardness of 7·5 have the color, lustre and cleavages of Andalusite. The circumstance which determines to the formation of these twin-crystals pertains apparently to the gangue; for the Macle occurs only in clay slate, while a similar aggregate, varying in hardness from 3·0 to 7·5, is found imbedded in single crystals of the form of fig. 12, in veins of Quartz, at the same locality. Before the blowpipe, Macle affords a little moisture without suffering any alteration. In a white heat, its color becomes white, but it does not undergo the slightest fusion. With borax, it is with much difficulty dissolved into a transparent glass. According to a recent analysis of LANDGREBE, it consists of Silica 68 497, Alumina 30·109, Magnesia 1·125, Water and Carbon 0·269; and another by JACKSON, of Silica 33·0, Alumina 61.0, protoxide of iron 4·0, and Water 1·50.

2. Alone, before the blowpipe, it whitens in spots, but does not melt. With borax, it dissolves with great difficulty into a transparent and colorless glass.

3. *Analysis.*

	By VAUQUELIN, from Spain.	By BRANDES, from Tyrol.
Silica	32·16	34·000
Alumina	52·24	55·750
Potash	8·10	2·000
Oxide of iron	2·00	3·375
Loss	6·00	0·000
Lime		2·125
Magnesia		0·375
Oxide of manganese		3·625
Water		1·000

4. Crystals of Andalusite are found imbedded in mica slate, or implanted in the cavities of rocks forming irregular beds or nodules in gra-

nite and primitive slate. It is generally associated with Quartz, sometimes with a decomposing Mica.

5. This species was first discovered in the province of Andalusia in Spain. Crystals of very considerable magnitude are found in the valley of Lisenz near Inspruck in the Tyrol. It also occurs near Bräunsdorf in Saxony, at Herzogau in the Upper Palatine, at Forez in France, in grey dolomite containing Hornblende in the Simplon, and in black limestone with granular Iron-Pyrites at Coulepeux in the valley of Ger, (Haut Garonne,) in mica-slate in Aberdeenshire in Scotland, in the counties of Wicklow and Dublin in Ireland. In the United States at Westford, Mass. it occurs abundantly both crystallized and massive. A few handsome crystals have also been found at Litchfield, (Con.)

6. The Chiastolite or Macle is found at a great number of places; but no where so plentifully, or under such a diversity of forms, as in the towns of Lancaster and Sterling, (Mass.) It is in Lancaster that the single crystals of Macle imbedded in Quartz have been found, and which occur under the common form of Andalusite. Foreign localities of Chiastolite are the following: St. Jago di Compostella in Spain, Barèges in the Pyrenees, the Bayreuth, Hartz, and Cumberland in England.

ANDREOLITE. (See *Harmotome.*)

ANGLARITE. (See *Vivianite.*)

ANGLESITE. Prismatic Lead-Baryte.

MOHS.

Primary form. Right rhombic prism. M on M′ = 103° 42′.

Secondary forms.

Fig. 21.

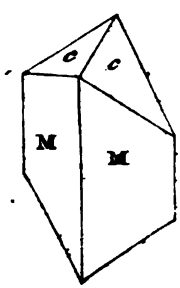
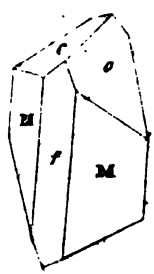


Fig. 22.



Anglesite.

Fig. 23.

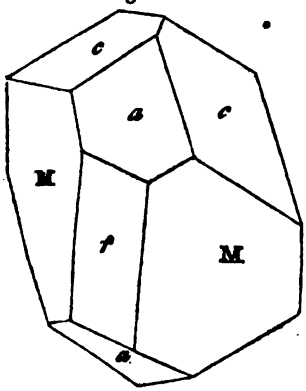


Fig. 24.

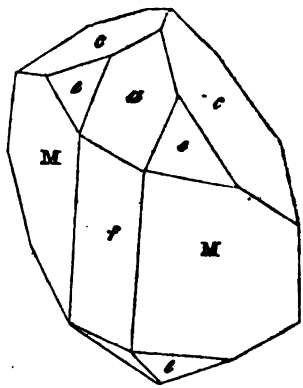
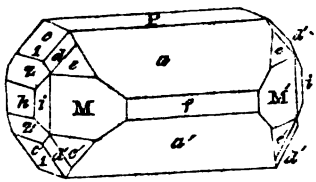


Fig. 25.



M on M′	-	103°	47′	M on *h*	-	128°	10′
P on *a*	-	140	36	M on *c*1	-	127	56
P on *e*	-	115	40	M on *i*	-	160	42
P on *f*	-	90	00	*a* on *a*′	-	79	30
P on *h*	-	90	00	*a* on *f*	-	129	28
M on *c*	-	153	20	*c*1 on *c*1′	-	104	30
M on *f*	-	141	52	*c*1 on *c*2	-	142	20

Cleavage, parallel with M and *f* imperfect and interrupted. Fracture conchoidal. Surface, M and *f* often striated parallel to the axis, *a* in a horizontal direction. In general the faces are smooth, and often of high degrees of lustre.

Lustre adamantine, inclining to vitreous and resinous. Color yellowish, greyish, or greenish white, also yellowish, smoke and ash-grey. Sometimes faintly tinged green or blue. Streak white. Transparent... translucent.

Brittle. Hardness = 2·5 ... 3·0. Sp. gr. = 6·298.

Compound Varieties. Massive: composition lamellar, also granular, of various sizes of individuals, often strongly connected. Faces of composition rough.

1. It decrepitates in the flame of a candle, and frequently assumes a slight reddish tinge on the surface. Reduced to powder it melts easily before the blow-pipe into a white slag, which is reduced to metallic lead by the addition of soda.

2. *Analysis.*

By Stromeyer.

Oxide of lead . . .	72·47
Sulphuric acid . . .	26·09
Water . . .	0·12
Hydrous oxide of iron . . .	0·09
Oxide of manganese . . .	0·06
Silica . . .	0·51

3. It is found in lead and copper veins, traversing clay-slate and greywacke slate, along with various ores of lead and copper.

4. It is found at the Lead hills and Wanlockhead in Scotland, Pary's mine in Anglesea, Mellanoweth in Cornwall; also at Clausthal and Zellerfeld in the Hartz, near Freiberg in Baden, at Siegen in Prussia, in Spain, and Siberia.

It occurs along with Galena in the lead mines of Missouri: also in the lead mine of Southampton, (Mass.)

ANHYDRITE. Prismatic Gypsum-Haloide. Mohs.

Primary form. Right rectangular Prism.

Anhydrite.

Secondary form.

Fig. 26.

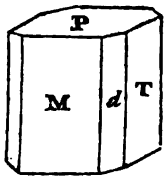
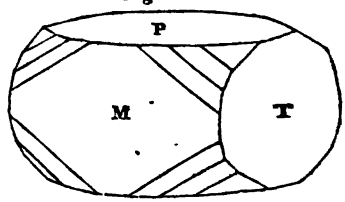


Fig. 27.



P on M, or T	-	-	90°	0′
M on T	-	-	90	0
M on *d*	-	-	140	4
T on *d*	-	-	129	56

Cleavage parallel with M and T perfect; less easily obtained parallel with P, yet quite distinct.

Fracture imperfectly conchoidal, uneven. Surfaces M and T smooth; P rough.

Lustre vitreous, inclining a little upon the most distinct faces of cleavage to pearly. Color generally white, sometimes passing to flesh-red, violet-and smalt-blue or ash-grey. Streak greyish-white. Transparent . . . translucent.

Brittle. Hardness = 3·0 . . . 3·5. Sp. gr. = 2·89.

Compound Varieties. Contorted; composition columnar in thin fibres, parallel and variously bent. Massive: composition granular, of different sizes, sometimes impalpable, and then the fracture is splintery; in other massive varieties, the composition is columnar, commonly thin and parallel. Faces of composition rough.

1: This species has been divided into several subspecies in the earlier treatises on mineralogy. Thus the *Cubic Muriacite*, also called Cube spar, comprehends simple varieties, and easily cleavable compound ones, in which the individuals possess a considerable size. The name *Anhydrite* was appropriated to varieties of a smaller granular composition, and

that of *Tripe stone* (*Gekrösstein*) to the contorted compositions, consisting of thin columnar individuals. *Compact* and *fibrous* Muriacite were the denominations of compound varieties of very small individuals, the one granular and impalpable, the other columnar. The *Vulpinite* of Italy, so named from its locality, is composed of granular individuals, a little longer in one direction, of a greyish white or grey color, and very much resembling a coarse grained, primitive marble.

2. When heated alone in a matrass, it yields no moisture. Before the blow-pipe in platina forceps, it is converted, with difficulty, into a white enamel, the heated mass affording when moistened an alkaline reaction. With borax, it dissolves, accompanied by effervescence, into a transparent glass, which on cooling assumes a yellow or brownish yellow color.

3. *Analysis.*

By KLAPROTH,
a cleavable variety from Hall in the Tyrol.

Sulphuric acid	55·00
Lime	41·75
Muriate of soda	1·00

Except the muriate of soda, the other varieties which have been analyzed, have presented nearly the same proportions.

By a peculiar process, which is natural, Anhydrite attracts water, loses its transparency, becomes diminished in hardness and specific gravity and approaches in these properties common Gypsum. The cleavage of this altered substance still enables us to distinguish it from Gypsum. It has been called *Chaux sulfatée épigène* by HAUY.

4. Anhydrite is found in beds of gypsum, and of clay along with common salt. It also occurs with metallic minerals, as Galena and Blende.

5. Splendid geodes of large and well defined crystals (fig. 11.) of Anhydrite have been found at Aussee in Stiria; other crystallized varieties at Hall in the Tyrol, at Hallein in Salzburg, in Switzerland, &c. The blue variety is found at Sulz on the Neckar, and at Bleiberg in Carinthia. Foliated Anhydrite, transparent and of a fine blue color, is frequently met with in geodes in the black limestone at Lockport, (N.Y.) associated with crystals of Calcareous spar and Gypsum. Columnar varieties occur at Ischel and Berchtesgaden; compact ones, in the Hartz, in Mansfeld, &c.; the contorted varieties are found at Wieliczka and Bochnia in Poland. The decomposed Anhydrite occurs in considerable quantities at Aussee in Stiria, at Bex in Switzerland, and in other places. It is observed at Lockport in thin coatings upon the foliated variety above alluded to, and also filling up crevices among the foliæ.

6. The blue varieties, in which the granular particles of composition cohere more firmly than in others, are cut and polished for various ornamental purposes, and are known in the arts by the name of *Marmo bardiglio di Bergamo.*

ANHYDROUS SILICATE OF IRON.

Massive: foliated.
Cleavage, divides easily into four-sided prisms.
Color dark brown, opake.
Hardness = 4. Sp. gr. = 3·884.
Brittle. Attracted by the magnet.

1. Heated in a glass-tube, it emits ammoniacal vapors, and loses 1·97 of its weight. Alone before the blow-pipe, it is infusible, but in the reducing flame acquires a metallic lustre, and assumes the appearance of magnetic iron. Dissolves in muriatic acid by the aid of heat, without effervescing, leaving behind a quantity of silica in flakes.

2. *Analysis.*
By THOMSON.

Silica	29·600
Protoxide of iron . . .	68·605
Protoxide of manganese . .	1·857

3. It is found at Sclavcorrach, one of the Morne mountains, in the north-east of Ireland.

4. Not enough is known concerning the foregoing mineral to pronounce upon its specific character with certainty. It scarcely differs from Yenite except in being attracted by the magnet, and in its infusibility.

ANKERITE. Paratomous Lime-Haloide.
MOHS.

Primary form. Rhomboid. P on P = 106° 12′.

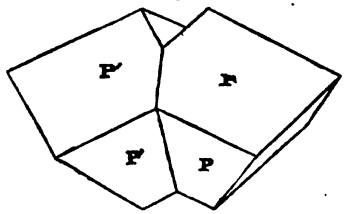
Cleavage parallel with the primary faces perfect. Fracture uneven.

Lustre vitreous, slightly inclining to pearly. Color white, with various tints of grey, red and brown. Streak brown, Translucent, often very faintly.

Brittle. Hardness = 3·5 . . . 4·0. Sp. gr. = 3·080.

Compound Varieties. Twin-crystals. Face of composition parallel with the vertical axes.

Fig. 28.



Massive: composition granular, individuals in most cases easily discernible, often mixed with Calcareous Spar. Faces of composition uneven and rough.

1. It becomes black before the blow-pipe without melting, and acts upon the magnetic needle. With borax it melts into a pearl. The color is darkened on the surface by being exposed to the air.

2. *Analysis.*

By SCHRÖTTER.

Carbonic acid with oxide of iron	35·808
Lime	50·113
Magnesia	11·846
Oxide of manganese . . .	3·084

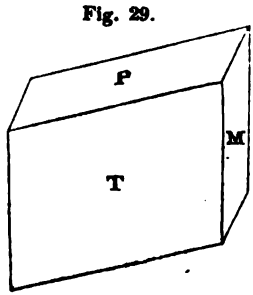
3. The Ankerite occurs in the Rathhausberg in Salzburg upon beds in mica-slate, and in many places upon the beds of Heavy Spar, extending from Stiria along the whole chain of the Alps. The Ankerite forms veins in the transition limestone about the city of Quebec, and in the U. States it occurs in connexion with the coal formation at West Springfield, (Mass.)

ANORTHITE. Anorthotomous Feldspar.

PARTSCH.

Primary form. Doubly oblique prism.

Fig. 29.

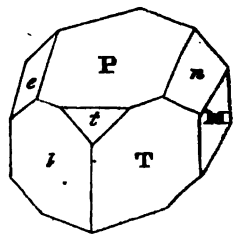


M on P	-	94°	12′
M on T	-	117	28
P on T	-	110	57

Secondary form.

M on *l*	-	-	117°	25′
T on *l*	-	-	120	30
P on *e*	-	-	137	32
P on *n*	-	-	133	13
P on *t*	-	-	138	46

Fig. 30.



Cleavage, parallel to P and M; none parallel to T.

Fracture conchoidal.

Surface of T more smooth than of *l*.

Lustre pearly upon cleavage planes, vitreous in other directions. Color white. Streak white. Transparent . . . translucent.

Brittle. Hardness = 6·0. Sp. gr. = 2·763 (massive); = 2·656 (small crystals, apparently not entirely free from Augite.)

1. Before the blow-pipe it behaves like Feldspar, except that with soda it does not give a clear glass. It is entirely decomposed by concentrated muriatic acid.

2. *Analysis.*
By Rose.

Silica	44·49
Alumina	34·46
Oxide of Iron	0·74
Lime	15·68
Magnesia	5·26

3. The only locality of Anorthite is Mount Vesuvius. It is found lining cavities in Limestone, along with a green variety of Augite.

ANTHOPHYLLITE. Prismatic Schiller-Spar. Mohs.

Anthophyllite.

Primary form. Oblique rhombic prism. P on P′= 125°.

Cleavage parallel to the sides of the primary form and both its diagonals,—the cleavage parallel to the longer diagonal being more distinct and easily obtained.

Fracture uneven.

Surface streaked parallel to the axis.

Lustre pearly, inclining to metallic, particularly upon the perfect face of cleavage. Color between yellowish-grey and clove-brown. Streak white. Translucent, sometimes, only on the edges.

Brittle. Hardness=5·0 . . . 5·5. Sp. gr.=3·129.

Compound Varieties. Massive; composition columnar, straight, sometimes divergent and rather broad; faces of composition irregularly streaked. They are often aggregated in a second composition, which is angulo-granular and wedge-shaped.

1. Alone before the blow-pipe, it is unalterable except in very thin fragments, when it fuses on the edges into a black slag. With borax, it melts with difficulty into a glass, colored by iron.

2. *Analysis.*

	By John.	By Thomson.	By Gmelin.
Silica	56·00	56·290	56·00
Alumina	13·30	1·545	3·00
Magnesia	14·00	19·665	23·00
Lime	3·33	0·000	2·00
Oxide of iron	6·00	7·280	0·00
Oxide of manganese	3·00	0·000	4·00
Water	1·43	1·685	0·00
Potash	0·00	13·500	12·00

3. Anthophyllite occurs in beds of mica-slate, accompanied by Garnet, Talc, Augite, Iolite, &c.

4. It has been brought from the cobalt and copper mines of Kongsberg and Modum in Norway. It is found with Augite in Greenland; and

with Tourmaline and Iolite at Haddam, (Con.) It also occurs with Quartz in mica-slate, at Chesterfield and Blandford, (Mass.)

ANTHRACITE. Non-Bituminous Mineral-Coal. MOHS.

No regular form or structure. Massive, generally impalpable; rarely vesicular, and sometimes divided into columnar masses, meeting in rough faces.

Fracture conchoidal, often perfect.

Lustre imperfect metallic. Color iron-black, sometimes inclining to greyish black, often beautifully tarnished. Streak unchanged. Opake.

Not very brittle. Hardness = 2·0 ... 2·5. Sp. gr. = 1·4.

1. The *Columnar Glance-Coal* of JAMESON, and the *Mineral Carbon*, or *Mineral Charcoal*, are both varieties of Anthracite. The former is remarkable for its irregular columnar composition, which is probably produced by fissures, and the low degree of lustre in its fracture: the latter occurs in thin layers and massive specimens of a very delicate columnar composition, and presenting a silky lustre.

2. The varieties of the present species do not contain any bitumen, but consist wholly of carbon, occasionally mixed with a small proportion of oxide of iron, silica and alumina. They are inflamed with difficulty, and burn without smoke or bituminous smell and with little or no flame,—leaving a more or less considerable earthy residue.

3 Anthracite is found occasionally in more ancient rocks; but its principal deposits are in secondary strata, consisting of coarse sand stones, greywacke and slate. It is sometimes met with in veins traversing trap rocks.

4. Vast deposits of Anthracite are found in the United States. The most celebrated of these is the anthracite region, so called, of the Susquehanna, situated chiefly in Luzerne county, (Pen.) It is between sixty and seventy miles long, and about five broad, constituting a trough or elongated basin, through which the Susquehanna river and Lackawanna creek, flow. The Anthracite breaks out throughout this region in precipices and hills, forming in some places the beds of the rivers and

smaller streams which descend from the mountains; and the whole of this extent is completely overlaid by coal beds of various thicknesses, repeated again and again with their attendant rocks. The neighboring counties of Schuylkill and Lehigh abound in this species also, where it occurs under similar circumstances. The Anthracite of Pennsylvania is distinguished by its sub-slaty and conchoidal fracture. Very frequently also, it is liable to the most splendid tarnishes which this species ever presents. A second Anthracite region is Rhode Island, where a formation exists at Portsmouth; and a third in Worcester, (Mass.) The Anthracite of these last mentioned districts is remarkable for its irregular columnar composition, dull grey color, and low degree of lustre. This last variety is found on the Meissner in Hessia, forming the uppermost division of a bed of bituminous wood, covered by basalt. It also occurs in Scotland. The slaty Anthracite is found at Schönfield in Saxony, in Savoy, at Kongsberg in Norway, at Staffordshire in England, in Ayrshire Scotland, and at Kilkenny in Ireland.

5. On account of the difficult inflammability of this species of coal, and its scarcity in Europe, it appears to have attracted little attention for economical purposes. Its abundance in this country however, and the cheapness with which it is raised, (it being worked in open quarries,) have brought it into extensive use. At present, it forms the principal fuel in the maritime cities of the northern states, and is applied to nearly every purpose of raising temperature.

ANTHRAKONITE.

An impure Calcareous Spar, which owes its prismatic concretionary form to some species of *Favosites*.

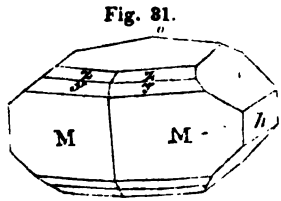
ANTIMONIAL SILVER. Prismatic Antimony.

MOHS.

Primary form. Right rhombic prism?

Secondary form.

Fig. 81.



M on M - - - 120° 0′

Antimonial Silver.

Cleavage parallel to *o* and P distinct; cleavage parallel to M imperfect.

Fracture uneven.

Surface in general smooth.

Lustre metallic. Color silver-white, inclining to tin-white. Streak unchanged.

Hardness = 3·5. Sp. gr. = 9·44 . . . 9·8.

Compound Varieties. Twin-crystals like those of Aragonite and White Lead-Ore. Massive: composition granular, individuals of various sizes, and easily separated.

Pseudomorphic six-sided prisms.

1. Before the blow-pipe, it yields a globule of silver, while the antimony is driven off.

2. *Analysis.*

Silver - - - - -	76·5
Antimony - - - - -	23·5

3. It is found accompanied by Native Silver, Native Arsenic, Galena and various other species. Its localities are Altwolfach in Fürstenberg, and Andreasberg in the Hartz.

4. The *Arsenical Silver* is considered as a more or less intimate mechanical mixture of Native Arsenic, or of Mispickel with Antimonial Silver. It possesses the color of Native Silver, but is commonly tarnished externally of a blackish color. It occurs in small, curved lamellar compositions, consisting of very thin crystalline coats. It is harder than Antimonial Silver. Before the blow-pipe, the arsenic and antimony are for the most part volatilized, leaving a globule of impure silver, surrounded by a slag. A specimen from Andreasberg afforded Klaproth,

Arsenic - - - - -	35·00
Antimony - - - - -	4·00
Silver - - - - -	12·75
Iron - - - - -	44·25

Its localities are the same as those mentioned for Antimonial Silver, and in addition, it comes from Guadalcaual in Estremadura in Spain.

5. It is valuable for the extraction of silver.

Antimony Phyllite.

Primary form. Rhombic prism. Dimensions unknown, and likewise whether the prism be right or oblique.

Apatite.

Secondary form. A thin, six-sided prism derived from a rhombic prism, through the truncation of the acute edges.

Cleavage parallel with the lateral planes of the primary form, and with its shorter diagonal.

Fracture scarcely observable.

Surface uneven.

Lustre pearly, inclining to adamantine. Color greyish-white. Translucent.

Sectile. Thin laminæ are flexible, like Talc.

Hardness = 1·0 . . . 1·5. Sp. gr. = 4·025.

1. Before the blow-pipe, it conducts like white Antimony. A copious precipitate of oxide of antimony is thrown down from its solution in muriatic acid, by water.

2. But two specimens of this mineral, the one at Dresden and the other at Halle, have been seen; and their locality is unknown.

APATITE. Rhombohedral Fluor-Haloide. Mohs.

Primary form. Regular hexagonal prism.

Secondary forms.

Fig. 32.

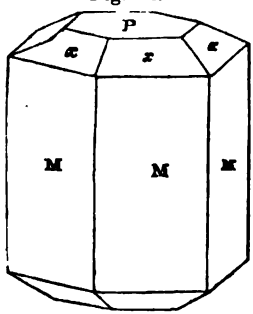
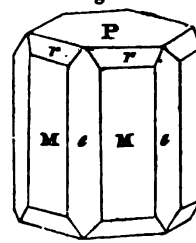


Fig. 33.



M on *x*	-	-	129°	13′	53″	Hauy.
P on *x*	-	-	140	46	7	
x on *x*	-	-	143	7	48	
M on *e*	-	-	150	00	00	Hauy.
M on *r*	-	-	112	12	28	
P on *r*	-	-	157	47	32	

Apatite.

Fig. 34.

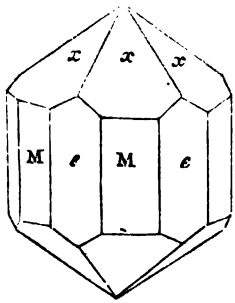


Fig. 35.

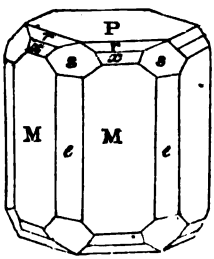
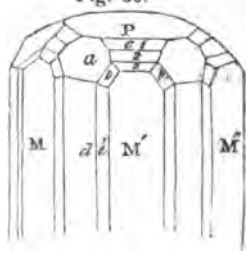


Fig. 36.



P on *s*	-	-	125°	15′	52″	HAUY.
e on *s*	-	-	144	44	8	
M on *s*	-	-	135	00	00	
r on *x*	-	-	162	58	33	
M or M′ on *d*		-	150	00	00	PHILLIPS.
M on *e*	-	-	169	2	00	
P on *c*1	-	-	157	00	00	
P on *c*2	-	-	134	43	00	
P on *c*3	-	-	120	38	00	
P on *a*	-	-	124	16	00	
M on *c*1	-	-	112	48	00	
M on *c*2	-	-	130	30	00	
M on *c*3	-	-	139	48	00	
M′ on *b* or *b*′		-	149	40	00	
b on *a*	-	-	162	18	00	

The planes *bb* are rarely seen together on the same crystal.

Apatite.

Cleavage parallel with the planes of the primary form, that parallel with the base obtained with most difficulty.

Fracture conchoidal, more or less perfect, uneven.

Surface, the secondary faces generally very smooth; the primary lateral ones striated in a longitudinal direction. Sometimes all the edges are rounded.

Lustre vitreous, inclining to resinous. Color white, frequently violet-blue, mountain-green, or asparagus green; also yellow, grey red and brown colors, though none of them are bright. Transparent or translucent. A bluish opalescence appears upon the faces parallel to the principal axis in some crystals, particularly the white varieties.

Brittle. Hardness = 5·0. Sp. gr. = 3·225 (asparagus-green crystals from Spain); = 3·180, from Salzburg.

Compound Varieties. Implanted globular and reniform shapes: composition imperfectly columnar; faces of composition rough. Massive: composition granular, individuals of different size, not impalpable; faces of composition uneven or rough.

1. Several varieties of the present species which are decidedly separate from others and connected among themselves, were formerly considered as forming two or even three distinct species. The distinctive marks between them, however, are so slight, that they are incapable of being indicated with certainty, and it would therefore be superfluous to attempt their explanation.

2. Certain varieties are phosphorescent upon ignited charcoal and before the blow-pipe; in particular those crystals which are terminated by a single plane, some of which phosphoresce when rubbed with hard bodies. In a very strong heat of the blow-pipe, the edges and solid angles are rounded off; but it does not melt without addition. With borax, it dissolves slowly into a clear glass. With salt of phosphorus it dissolves in great quantities, affording a transparent glass, which, when nearly saturated, becomes opake in cooling, and presents crystalline faces, similar, but less distinct than phosphate of lead. Apatite has been artificial-

ly formed by exposing a mixture of phosphoric acid and sulphate of lime to a high temperature. It exhibits a lamellar texture, and shows by heat on opposite ends, opposite kinds of electricity,—a property not hitherto observed in the natural crystals of Apatite.

3. *Analysis.*

	By KLAPROTH.	By VAUQUELIN, from Spain.	By PELLETIER & DONADEI, fr. Spain.
Lime	55·0	54·28	59·0
Phosphoric acid	45·0	45·72	34·0
Carbonic acid	.	.	1·0
Muriatic acid	.	.	0·5
Fluoric acid	.	.	2·5
Silica	.	.	2·0
Iron	.	.	1·0

4. There are examples of Apatite entering as an occasional admixture into the composition of rocks, as granite and limestone. But it more frequently appears in beds and veins, consisting chiefly of ores of iron and tin, or of crystallized varieties of those species of which the rocks themselves are composed. The crystallized variety, called *Asparagus-stone* from Spain, is found in an ancient volcanic rock, along with Specular Iron and compact Calcareous-spar. The compound varieties, called *Phosphorite*, of the same country, form particular beds.

5. Ehrenfriedersdorf in Saxony, Schlackenwald in Bohemia, the Greiner mountain in Salzburg, Cabo de Gata in Spain, Devonshire and Cornwall, are some of the most distinguished localities of this species. Arendal in Norway affords the bluish green and reddish brown crystals, (*Moroxite*); St. Gothard in Switzerland, and Heiligenbluter Tauern in Salzburg, furnish remarkable white, transparent crystals; and Estremadura in Spain, and Schlackenwalk in Bohemia, produce massive varieties, while a pulverulent variety is found at Marmarosch in Hungary. Small yellow crystals occur at Partridge Island in Nova Scotia.

Apatite has been found in many places in the United States; but we possess but one locality which affords it in any considerable quantity, or in well crystallized specimens, and this is at Governeur, St. Lawrence Co. (N.Y.) where it occurs crystallized in granular limestone, the crystals being very abundant, large, (sometimes 4 or 6 inches in length,) well defined, having the form of fig. 35, (except *r*,) and possessing a rich sea-green or mountain-green color. Crystals several inches long, of the primary form have been obtained at Amity, (N.Y.) where it occurs of a green

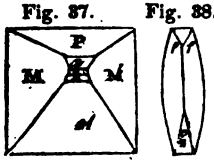
color in white limestone, associated with brown Augite and Scapolite. At Bolton, (Mass.) it occurs crystallized and massive, of a bluish green color, under similar circumstances, with the addition of Petalite and Sphene. Handsome green crystals have been found at Monroe, (Con.) in granite: but they are scarce. Very distinct crystals an inch or more in length, of a reddish brown color, are occasionally met with in a vein of granite at Greenfield, (N.Y.) acccompanied by Chrysoberyl, Tourmaline and Garnet. The following localities of Apatite in small green or yellowish green crystals, imbedded in granite, are quoted in Cleaveland's Mineralogy, viz., near Baltimore, (Maryland,) near Wilmington, (Delaware,) near Philadelphia, New York and New Haven; also the following in Iron Pyrites:—near Green Pond, Morris co. (N.Y.) and at Anthony's Nose in the Highlands of New York.

APHANESITE. Aphanistic Copper-Baryte.

Primary form. Oblique rhombic prism. M on M′ = 56°. P on M = 99° 30′.

Secondary forms.

Fig. 37. Fig. 38.



P on *a*1	-	-	125°	00′
P on *c*1	-	-	80	30
P on *c*2	-	-	99	30
f on *f*′	-	-	62	30

Lustre pearly upon the face of perfect cleavage. Color dark verdigris-green, inclining to sky-blue, still darker on the surface. Streak verdigris green. Translucent on the edges.

Not very brittle. Hardness = 2·5 . . . 3·0. Sp. gr. = 4·192.

1. Before the blow-pipe it deflagrates and emits arsenical vapors.

2. *Analysis.*
By Chenevix.

Oxide of copper . . .	54·00
Arsenic acid . . .	30·00
Water . . .	16·00

3. It has hitherto been found only in Cornwall, with several other species of the salts of copper, and with Copper Pyrites and Quartz.

APHRITE. (See *Calcareous-Spar.*)

APLOME. (See *Garnet.*)

APHTHITALITE. Prismatoidal Glauber-Salt.

Massive;* mammillary, apparently formed in successive layers.

Lustre vitreous. Color white, with certain bluish or greenish stains. Translucent.

Rather brittle. Hardness = 2·5 ... 3·0. Sp. gr. = 1·731.

Taste saline and bitter, disagreeable.

1. It has not been analyzed, but probably will be found to be a sulphate of potash, with a trace of sulphate and muriate of copper.
2. It occurs at Mount Vesuvius.

APOPHYLLITE. Pyramidal Kouphone-Spar. MOHS.

Primary form. Right square prism.

* The artificial crystals are right rhombic prisms of 112° 8′, having their acute angles replaced so as to form dihedral summits of 106° 46′, and having the lateral edges truncated.

Apophyllite.

Secondary forms.

Fig. 39.

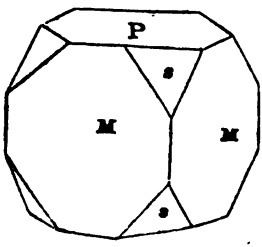


Fig. 40.

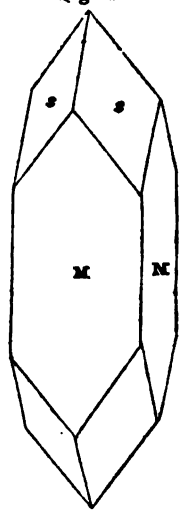


Fig. 41.

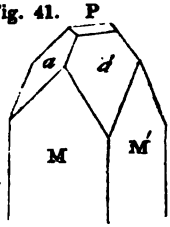


Fig. 42.

M on *s*	-	-	-	127°	59′	HAUY.
P on *s*	-	-	-	119	30	
s on *s*	-	-	-	104	2	
P on *a*	-	-	-	120°	5′	PHILLIPS.
M on *a*	-	-	-	128	20	
a on *a*	-	-	-	104	18	

Cleavage, parallel with the primary faces, most perfect at right angles to the axis.

Fracture uneven.

Surface smooth and shining.

Lustre vitreous. The natural and cleavage face P possess pearly lustre. Color several shades of white, greyish, bluish or reddish. Streak white. Transparent . . . translucent.

Brittle. Hardness = 4·5 . . . 5·0. Sp. gr. = 2·335.

Compound varieties. Massive: composition lamellar, straight, or slightly curved.

1. Before the blow-pipe, it first exfoliates, then intumesces like borax, and melts at last into a white vesicular globule. It is easily dissolved by borax. It is positively electrified by friction, but not by heat. It likewise exfoliates in acids; and its powder forms with them, a jelly.

2. *Analysis.*

	By Berzelius, from Utoen.	By Stromeyer, from Faroe.
Silica	53·13	52·38	51·26
Lime	24·71	24·98	25·20
Potash	5·27	5·27	5·14
Fluoric acid	0·82	0·64	0·00
Water	16·20	16·20	16·04

3. The natural repositories of Apophyllite are the vesicular cavities of amygdaloidal rocks, or metalliferous beds with Augite, Calcareous Spar and Copper Pyrites.

4. Some of the finest varieties are from the amygdaloid of Iceland and the Faroe islands. Likewise near Indore in India. Under similar circumstances it occurs at Mariaberg, near Aussig in Bohemia, and the variety from thence has been called *Albin*. It has been found occupying drusy cavities of a very extensive bed of limestone in gneiss, containing ores of copper, at Czcklowa, near Orawitza in the Bannat. Other localities are New South Shetland, and several iron-mines in Sweden and Norway.

The only known localities in North America are Peter's Point and Partridge Island in the Basin of Mines, Nova Scotia.

ARFWEDSONITE. Peritomous Augite-Spar. Partsch.

Primary form. Oblique rhombic prism. M on M′ = 123° 55′, from cleavage.

Cleavage parallel with the sides of the prism, producing brilliant faces.

Arragonite.

Lustre vitreous. Color black. Opake.
Hardness inferior to Hornblende. Sp. gr. =3·44.

1. It melts easily before the blow-pipe into a black globule. With borax, it gives a glass colored by iron; with salt of phosphorus, likewise, but paler, and becoming colorless on cooling, whilst a dark grey silica-skeleton remains undissolved.

2. It occurs along with black Augite and black Sodalite in Greenland, and has generally been considered as a ferruginous variety of Hornblende, from which, however, its brilliant cleavages, the inclination of its lateral faces and inferior hardness, seem sufficiently to distinguish it as a new species.

The mineral generally taken for a variety of Hornblende in a porphyritic trap from Plymouth, (Vt.) appears to agree with the above description.

ARRAGONITE. Prismatic Lime Haloide. Mohs.

Primary form. Right rhombic prism. M on M′ = 116° 10′.

Secondary forms.

Fig. 43.

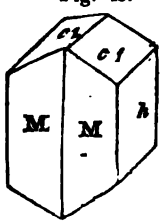
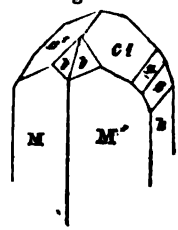


Fig. 44.



M on *c*1	-	-	108°	18′	Bilin, Bohemia.
M on M′	-	-	116	10	Phillips.
M′ on *h*	-	-	121	38	
h on *c*1	-	-	125	55	
*c*1 on *c*1	-	-	108	18	
M on *b*	-	-	144°	00′	Phillips.
*c*1 on *c*2	-	-	150	30	
*c*1 on *c*3	-	-	141	00	
*c*1 on *b*	-	-	136	30	
b on *b*	-	-	129	33	

Arragonite.

Cleavage, parallel with the lateral faces of the primary form.

Fracture conchoidal, uneven.

Surface generally smooth. The curvature of the sides parallel to the prismatic axis very often produces acicular crystals, variously aggregated.

Lustre vitreous, inclining to resinous upon faces of fracture. Color white, prevalent; sometimes passing into grey, yellow, mountain-green and violet blue. Streak greyish white. Transparent . . . translucent.

Brittle. Hardness=3·5 . . . 4·0. Sp. gr.=2·931, (the transparent crystals from Bohemia.)

Compound varieties.

Fig. 45. Fig. 46. Fig. 47.

Arragon.

Fig. 45. Formed from the composition of two individuals, like fig. 43, the angle of revolution being 90°.

Fig. 46. Formed from the composition of three individuals of the same form, as explained in § 73. Part I.

Fig. 47. The dotted lines represent the cracks observable down each plane, arising from the contact of the planes forming the dihedral summits of the several individuals of which fig. 46 is composed; and hence the six lateral planes of this apparently regular hexagonal prism are not flat; but each presents a slightly re-entering angle.

Globular, reniform, coralloidal shapes; surface drusy, composition columnar, the individuals being often very delicate, but also occurring of various dimensions; faces of

composition irregularly streaked. Massive: composition columnar, either parallel, or divergent, or irregular; and of different sizes of individuals.

1. Thin fragments of transparent crystals decrepitate in the flame of a candle; other varieties lose their transparency, and become friable. It phosphoresces upon red-hot iron, and is soluble in nitric and muriatic acid, with effervescence.

2. *Analysis.*

By STROMEYER.

Carbonate of lime	95·2965	99·2922
Carbonate of strontites	0·5090	4·1043
Water	0·1544	0·5992

The carbonate of strontites does not exist in constant proportions, and has not been found at all in the coralloidal varieties.

3. Imbedded crystals, generally twins, or consisting of a greater number of individuals, are found in compound varieties of Gypsum, mixed and colored with oxide of iron, accompanied by crystals of Quartz, which have likewise suffered a similar admixture. Other varieties occur in the cavities of basalt and other trap rocks, also in irregular beds and veins. It is found in beds of iron-ores, in those coralloidal varieties which have been called *Flos-ferri*, in which the component individuals are so minute that their form and structure is undistinguishable. It is also found in various repositories, along with several species, as Copper and Iron Pyrites, Galena and Malachite. It likewise occurs in lava.

4. The most beautiful crystals occur near Bilin in Bohemia, in a vein traversing basalt, and filled with a massive variety of the same species, consisting of large columnar particles of composition. The varieties of twin-crystals imbedded in Gypsum, are found in the kingdom of Arragon in Spain, from whence the name of the species has been derived. The greenish colored specimens are brought from Marienberg in Saxony, and Sterzing in the Tyrol. The finest varieties of Flos-ferri are found in the mines of Eisen-ertz in Stiria; it also occurs at Schemnitz, St. Marie mines, and in those of Baygorri and Vicdessos in the Pyrennees. In England, the Dufton lead mines furnish beautiful specimens in acicular crystals, and finely columnar masses of a satin lustre. Other localities are Mount Vesuvius, Iglo in Hungary, France, Scotland, Iceland and Silesia.

Arsenic-glance.

The Flos-ferri has been met with at Lockport, (N.Y.) coating gypsum in geodes, at Edenville, (N.Y.) lining cavities of Mispickel and Cube ore, and at Haddam, (Con.) and its vicinity, in thin seams between layers of gneiss. A fibrous variety occurs at Scoharie, (N.Y.) It also exists in numerous limestone caves of the south western states.

ARSENIATE OF COBALT. (See *Cobalt-Bloom.*)

ARSENIATE OF COPPER. (See *Aphanesite, Copper-Mica, Erinite, Euchroite, Liroconite* and *Olivenite.*)

ARSENIATE OF IRON. (See *Cube-ore.*)

ARSENIATE OF LIME. (See *Pharmakolite.*)

ARSENIATE OF NICKEL. (See *Nickel-Ochre.*)

ARSENICAL ANTIMONY GLANCE.

In reniform masses, consisting of thin and curved individuals. Fracture uneven.

Lustre shining to faint. Color tin-white to steel-grey.
Hardness = 2·0 . . . 3·0. Sp. gr. = 6·2.

1. Before the blow-pipe it melts, and during fusion emits fumes of Antimony and Arsenic. Decomposed by nitric acid, affording a white precipitate, soluble in muriatic acid.

2. It is found at Przibram in Bohemia, Allemont in Dauphiny, Poullaouen in Brittany, and Andreasberg in the Hartz.

ARSENIC-GLANCE.

Massive, botryoidal; composition columnar, individuals radiating.

Lustre metallic. Color dark lead-grey.
Hardness = 2·0 . . . 2·5. Sp. gr. = 5·2 . . . 5·5.

1. Fragments of it, held in the blaze of a lamp, take fire, and disseminate, amidst continual sparks, a greyish, arsenical vapor. Heated on platina foil, it is surrounded by a ring of crystallized arsenic acid; and as it diminishes perceptibly, the vapor is partly deposited in the form of a blackish-grey powder. Before the blow-pipe, upon charcoal, it burns, at first with a bluish flame, and disappears in a dense smoke. It does not melt, until just before it disappears, when a white metallic globule is obtained. In the matrass it gives, at first crystallized arsenic acid: afterwards, a grey smoke and metallic arsenic, without any perceptible residuum. It is soluble in nitric acid, and the solution (when the acid is

not in excess) gives a white precipitate on the addition of water. With hydriodic acid, it at first gives a blackish brown, and then a citron-yellow, precipitate.

2. *Analysis.*

By KERSTEN,
from Marienberg.

Arsenic	96·785
Bismuth	3·001

3. It occurs in small quantities only, at Palmbaum in Marienberg, accompanied by Native Arsenic, Red Silver, Fluor, Heavy Spar, Calcareous Spar, Copper Nickel, Native Silver, &c.

4. It is not probable that the bismuth is a necessary ingredient in this mineral, which might with more propriety be included under Native Arsenic.

ASBESTUS.

Silky varieties of *Hornblende, Pyroxene, Picrosmene* and *Nemolite:* q. v.

ASPARAGUS-STONE. (See *Apatite.*)

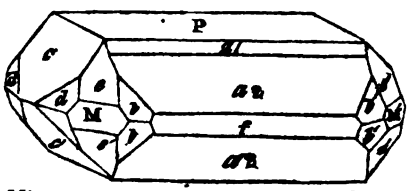
ASPHALTUM. (See *Bitumen.*)

ATACAMITE. Prismatoidal Habroneme-Malachite. PARTSCH.

Primary form. Right rhombic prism. M on M′=100°

Secondary form.

Fig. 48.



M on M′	100°	00′?	PHILLIPS.
P on *a*1	142	40	
P on *a*2	123	25	
P on *c*	127	12	
P on *e*	116	20	
*a*2 on *a*′2	112	45	
*a*2 on *c*	110	30	
*a*2 on *e*	143	25	
c on *c*′	107	10	
c on *d*	159	00	
c on *e*	137	40	
e on *e*	127	07	

The planes M M′ are the result of cleavage. Among the minute crystals are to be observed some in which the planes *a*2, *a*2′ and *c*, *c*′ of fig. 48 prevail to the exclusion of the rest, converting them to the form of an octahedron with a square base.

Cleavage parallel to P, less distinct parallel to M and M′. Colors, olive, leek, grass, emerald, and blackish-green. Streak apple-green. Nearly transparent . . . translucent on the edges.

Rather brittle. Hardness = 3·0 . . . 3·5. Sp. gr. = 4·43.

1. It communicates bright blue and green colors to the flame of a candle, or if exposed to the blast of the blow-pipe, it develops vapors of muriatic acid, and melts at last into a globule of copper. It is soluble without effervescence in nitric acid.

2. *Analysis.*

	By Proust.	By Klaproth.
Oxide of copper	76·595	73·00
Muriatic acid	10.638	10.10
Water	12·767	16.90

3. It is found at Remolinos in Chili, on Brown Iron-Ore; sometimes with Red Oxide of Copper and Malachite: it occurs also in Peru with some of the ores of silver. It is found in the form of fine sand in the river Lipas, in the desert of Atacama, (and hence the name of the species,) separating Chili from Peru. Other localities are, Schwarzenberg in Saxony, and Mount Vesuvius.

Atelestite.

Crystalline, in structure resembling Sphene.
Lustre resinous to adamantine. Color pure sulphur-yellow.
Transparent to translucent.
Hardness about 3. Heavy.

1. Before the blow-pipe, it affords the indications of bismuth.
2. It is found at Schneeberg.

ATMOSPHERIC-AIR. Pure Atmospheric-gas. Mohs.

Atmospheric-Water.

Gaseous. Transparent.

Sp. gr. =1·0. Nearly 800 times lighter than distilled water.

1. It is tasteless and without odor, except that of electricity, which it sometimes very manifestly exhibits. Though transparent, it nevertheless reflects a blue color when in large masses, as in the sky above us. The lower atmosphere is contaminated in a greater or less degree by every kind of air or vapor which can be formed by the various bodies that compose the earth's surface. Over the land especially, carbonic acid is mingled with it in a proportion generally equal to 0·001.

2. *Analysis.*

Nitrogen	79·00
Oxygen	21·00

3. Atmospheric-air constitutes the atmosphere, and surrounds the whole globe to the height of forty or forty-five miles.

ATMOSPHERIC WATER. Pure Atmospheric-Water. Mohs.

Liquid. Transparent.

Sp. gr. =1·0.

1. Its form of aggregation is continually liable to fluctuation from changes of atmospheric temperature; and instead of water there appears aqueous vapor, or steam, and ice and snow. Ice is commonly produced with too much rapidity to permit the separate crystals of which its masses are composed, to be distinctly visible. They have been observed, however, by Scoresby and Herincaut de Thury, under the form of hexahedral prisms, of which the terminal faces presented striæ parallel to the faces of the prism, and in some instances with truncated terminal edges. The sp. gr. of ice = ·92. The crystals of snow present an almost endless variety of forms, which are perfect geometrical figures. They are usually lamellar, and transparent; often in regular hexagons, having six points radiating from their centres, with parallel collateral ramifications in the same plane: in slender six-sided needles, or spines; and in combinations of hexagons and spines, producing stelliform, or wheel-shaped compositions. Dr. Brewster has observed quadrangular plates in the hoar-frost crystallized upon leaves and stones; which

leads to the conclusion that the system of crystallization in ice is a quadrangular prism, and not a rhomboid, as was formerly supposed. It is well known that no species in mineralogy, whose primitive form is the rhomboid, presents crystallizations similar to the star-like figures of snow. The hail-stones which fall in the spring have the form of spheric sections, consisting of opake, thin prisms, radiating from the centre: those formed during heavy thunder storms in summer, generally, affect the shape of irregular, flattish globules, consisting of columnar particles of composition, but often perfectly transparent, and sometimes enclosing air bubbles.

2. *Analysis.*

By Berzelius.

Oxygen	88·94
Hydrogen	11·06

When pure, it is destitute of taste or odor. But water which flows within or upon the surface of the earth, contains various earthy, saline, metallic, vegetable, or animal particles, which often materially affect its taste and smell, and sometimes considerably augment its specific gravity. Thus from the accidental presence of salts and acids are formed the different kinds of hard water, of acidulous and bitter waters, and sea water.

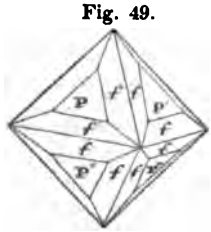
3. Pure atmospheric water descends from the atmosphere in the form of rain, mist, dew, snow or hail; it is also emitted from springs, and accumulated all over the globe in lakes, seas, &c.: in these last instances, however, it is contaminated with variable proportions of saline substances.

AUTOMOLITE. Octahedral Corundum. Mohs.

Primary form. Regular octahedron.

Secondary form.

Fig. 49.



Cleavage parallel with the primary faces.

Axinite.

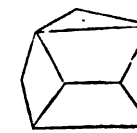
Fracture conchoidal.

Surface rough, sometimes covered with Mica or Blende.

Lustre vitreous, inclining to resinous. Color dirty green tinges, inclining to black and blue. Streak white. Translucent on the edges . . . nearly opake.

Hardness = 8·0. Sp. gr. = 4·232.

Fig. 50.



Compound varieties. Twin-crystals. The octahedral hemitrope. Massive: composition granular.

1. Alone before the blow-pipe, it is infusible, and nearly so with borax, or with salt of phosphorus. With soda, it melts imperfectly into a dark scoria, which being melted again with soda, deposits upon the charcoal an areola of oxide of zinc.

2. *Analysis.*

By Eckeberg.

Alumina	60·00
Oxide of zinc	24·25
Oxide of iron	9·25
Silica	4·75

3. Automolite generally occurs imbedded in talcose slate and quartz, and is accompanied by Galena, Blende, Garnet, Gadolinite, &c. It is thus found at Fahlun and Brodbo in Sweden.

In the United States, it occurs at Haddam, (Con.) along with Chrysoberyl, Garnet and Columbite in granite.

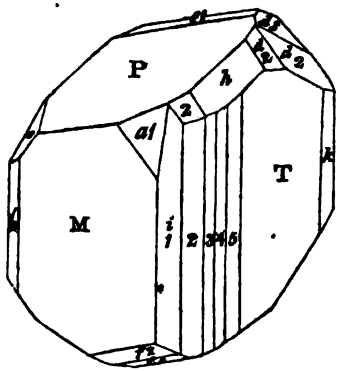
AXINITE. Tetarto-prismatic Axinite.

Primitive form. Doubly oblique prism? P on M = 134° 40′, P on T = 115° 17′, M on T = 135° 10′ (Phillips.)

Axinite.

Secondary form.

Fig. 51.



M on *a*1	-	179°	00′	M on *f*3	-	90°	18′
M on *a*2	-	150	3	T on *k*	-	147	55
M on *h*	-	146	35	T on *h*	-	152	5
M on *d*1	-	130	30	T on *d*1	-	149	30
M on *d*2	-	100	45	T on *d*2	-	130	5
M on *d*3	-	72	38	T on *d*3	-	94	12
M on *i*1	-	179	20	P on *a*1	-	133	25
M on *i*2	-	174	40	P on *c*	-	136	22
M on *i*3	-	152	25	P on *f*1	-	173	20
M on *i*4	-	142	28	P on *h*	-	143	20
M on *i*5	-	138	10	P on *d*1	-	139	30
M on *k*	-	120	00	P on *d*2	-	121	30
M on *c*	-	112	25	P on *d*3	-	110	20
M on *f*2	-	135	12				

PHILLIPS.

Cleavage indistinct and interrupted.

Fracture conchoidal, uneven.

Surface of M and T irregularly streaked. The secondary faces are smooth and shining.

Lustre vitreous. Color clove-brown, various shades inclining to plum-blue and pearl-grey. Green from an ad-

mixture of Talc. Streak white. Transparent...translucent, sometimes only on the edges. It exhibits the property of dichroism.

Hardness=6·5...7·0. Sp. gr.=3·271.

Compound varieties. Massive: composition lamellar, generally a little bent; faces of composition irregularly streaked. Sometimes the composition is granular and impalpable.

1. Before the blow-pipe it melts easily, and with intumescence, into a dark-green glass, which becomes black in the oxidating flame. Some varieties are differently electrified by heat, contiguous to opposite ends of the crystals, and in these also a difference has been observed by HAUY.

2. *Analysis.*

	By KLAPROTH.	By WIEGMANN.
Silica	50·50	45·00
Lime	17·00	12·50
Alumina	16·00	19·00
Oxide of iron	9·50	12·25
Oxide of manganese	5·25	9·00
Potash	0·25	0·00
Magnesia	0·00	0·25
Boracic acid	0·00	2·00

3. Axinite occurs in beds and veins in primitive countries. It is accompanied in the former situations by Calcareous Spar, Blende, &c.; in the latter, chiefly by Augite, Quartz, Feldspar and various metallic minerals.

4. It is found in beds at Thum near Ehrenfriedersdorf in Saxony, from whence it has sometimes been called *Thumite* or *Thumerstone*. At Kongsberg in Norway, it occurs in veins with Vitreous Silver. Beautiful crystals are met with in the veins of various places near Bourg d'Oisans in Dauphiny, at Barèges in the Pyrenees, in Savoy, in the county of Gömör in Hungary, and in large, well defined crystals at Botallack in Cornwall. In the latter place, it is found in a massive state, forming a peculiar kind of rock with Garnet and Tourmaline. It is also found at several places in the Hartz.

AZOTE. (See *Nitrogen.*)
AZURITE. (See *Lazulite.*)

BABINGTONITE. Axotomous Augite-Spar. PARTSCH.

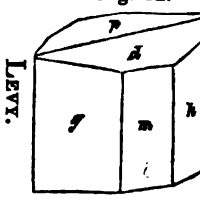
Primary form. Oblique rhombic prism. Dimensions unknown.

Secondary form.

p on *m*	-	-	92°	34′
p on *t*	-	-	88	00
t on *h*	-	-	155	25
m on *t*	-	-	112	30
m on *h*	-	-	137	·5
p on *d*	-	-	150	25
g on *m*	-	-	132	15
h on *g*	-	-	89	20

LEVY.

Fig. 52.



Cleavage distinct, parallel to *p* and *t*.

Fracture imperfectly conchoidal.

Lustre vitreous. Color black, often greenish; thin splinters are faintly translucent, and of a green color, perpendicular to *p*, of a brown color parallel to it. In large crystals, it appears opake.

Hardness = 5·5 . . . 6·0.

1. According to Mr. CHILDREN, it is composed of silica, iron, manganese and lime, with a trace of titanium.

2. It occurs at Arendal in Norway, in small crystals, (resembling dark colored crystals of Pyroxene,) disposed on the surface of crystals of Albite; and at Governeur, (N.Y.) coating crystals of Feldspar.

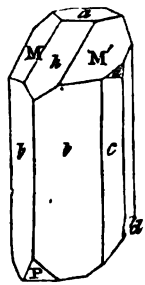
BARYTO-CALCITE. Hemi-Prismatic Hal-Baryte. MOHS.

Primary form. Oblique rhombic prism. M on M′= 106° 54′.

Baryto-Calcite.

Secondary form.

Fig. 53.



M on M' - - -	106°	54'
M on P - - -	102	54
b on *b* - - -	95	15
h on the edge between *b* and *b*	119	00
P - - - - -	135	00
c on *c* - - -	145	54

Cleavage perfect parallel to M and M'; less easily obtained, though perfect, parallel to P.

Fracture uneven, imperfectly conchoidal.

Surface *h* striated parallel to the edges of combination with M; the vertical planes parallel to the axis.

Lustre vitreous, inclining to resinous. Color white, greyish yellowish, or greenish. Streak white. Transparent... translucent.

Hardness =4·0. Sp. gr. =3·66.

Compound varieties. Massive: composition granular.

1. It does not melt alone before the blow-pipe, but gives a clear globule with borax. Like Witherite, it is soluble in muriatic acid.

2. *Analysis.*

By Children.

Carbonate of barytes	65·9
Carbonate of lime	33·6

It sometimes gives traces of iron and manganese.

3. It occurs at Alston moor in Cumberland, both massive and crystallized.

Batrachite.

Massive, with traces of a rhombic prism of 115°. Composition impalpable.

Beryl.

Cleavage parallel with the sides and shorter diagonal of the above prism, but mostly indistinct. Fracture small conchoidal.

Lustre resinous or vitreous; more inclined to the latter.

Color light greenish-grey, to almost white. Streak white.

Hardness = 5·0. Sp. gr. = 3·038.

1. Before the blow-pipe, it is fusible alone, without any perceptible change in the color of the flame. It affords a little moisture when heated in the matrass. It is slowly dissolved in phosphoric salt, leaving behind flocculi of silica. With soda, it is with difficulty dissolved into a dark colored pearl. From these and other experiments, it has been inferred by MERLET to be a silicate of magnesia.

2. It is found at Rizoni, a mountain in southern Tyrol.

BERGMANITE. (See *Scapolite*.)

BERYL. Rhombohedral Emerald. MOHS.

Primary form. Regular hexagonal prism.

Secondary forms.

Fig. 54.

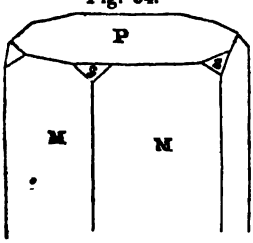
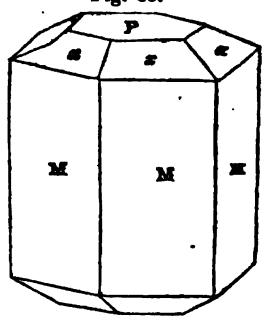


Fig. 55.



P on *s*	-	-	135° 00	HAUY.
M on *s*	-	-	127 45′ 40″	
P on *t*	-	-	150 00	
M on *t*	-	-	120 00	

Beryl.

Fig. 56.

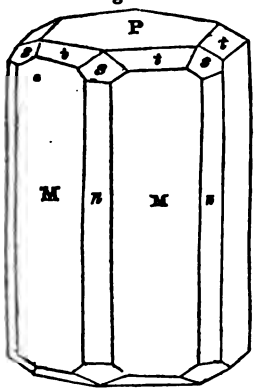
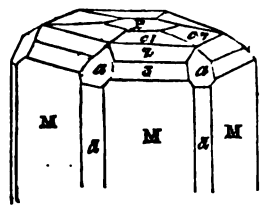


Fig. 57.



M on *n*	-	-	150° 00	HAUY.
n on *s*	-	-	135 00	
s on *t*	-	-	156 42′ 59″	
P on *a*	-	-	135 14′	PHILLIPS.
P on *c*2	-	-	159 10	
*c*1 on *c*′1	-	-	179 40	
M on *d*	-	-	150 00	

Cleavage, parallel to all the primary planes, but not distinct.

Fracture conchoidal, uneven.

Surface, the prisms striated parallel to the axis.

The pyramidal faces smooth.

Lustre vitreous. Color green, passing into blue, yellow and white: the brightest of these colors is emerald green; the greater part of the species, however, exhibits only pale colors. Streak white. Transparent... translucent.

Hardness=7·5 ... 8·0. Sp. gr.=2·732 of a perfectly emerald green variety; 2·678, of an apple-green crystal.

Beryl.

Compound Varieties. Massive: composition generally large granular, sometimes imperfectly columnar.

1. The only important differences between *Emerald* and *Beryl* are in the colors; which, since they produce an uninterrupted series, are altogether insufficient for a division of the present species. The color of Emerald is emerald green; all the varieties of other colors are Beryl.

2. In a strong heat of the blow-pipe, the edges are rounded off, and a shapeless vesicular scoria is produced. Transparent varieties become milky. It is dissolved by borax.

3. *Analysis.*

	By Berzelius, from Broddbo.	By Klaproth. The Emerald of Peru.
Silica	68·35	68·50
Alumina	17·60	15·75
Glucina	13·13	12·50
Oxide of iron	0·72	1·00
Oxide of columbium	0·27	0·00
Oxide of chrome	0·00	0·30
Lime	0·00	0·25

4. Beryl occurs in imbedded crystals in various rocks, most generally, however, in granite. It is also found in implanted crystals in veins and in beds. It is associated with Feldspar, Chrysoberyl, Topaz, Tin-ore, Garnet, &c. It is met with, likewise, in fractured crystals and rolled masses in secondary repositories.

5. The finest crystals of the emerald-green colors, or the true Emerald, come from Peru, where, according to Humboldt, it forms druses with Calcareous Spar, and occurs in veins traversing hornblende-slate, clay-slate and granite. It is sometimes accompanied by Quartz and Iron Pyrites. Less beautiful varieties are found imbedded in mica-slate in the valley of Heerbach, district of Pinzgau, Salzburg. The ancients procured their Emeralds from Egypt. Their localities have been rediscovered, and are situated in granite and mica-slate, in Mount Zalara, seven leagues from the Red Sea in Upper Egypt. Transparent crystals of bluish-green Beryl (called *Aquamarine*) are found in Siberia and Brazil. In Siberia it occurs in the granitic district of Nertschinsk, on the confines of China in compact ferruginous clay; also in the Uralian and Altai mountains, often in large crystals: in Brazil, it is found in fractured crystals in the sand of rivers. More common varieties are met

with at Limoges in France, near Zwiesel on the Rabenstein in Bavaria, at Finbo and Broddbo in Sweden, and in some of the tin mines of Saxony and Bohemia.

The Beryl is an abundant mineral throughout New England; and many of its localities are distinguished for the size and perfection of the crystals which they afford. The most remarkable of these is Acworth, (N.H.) about fifteen miles from Bellows' Falls. They occur at this place in a powerful vein of granite traversing gneiss. The largest crystals weigh from two to three hundred pounds, and measure four feet in length. Their form is that of tolerably perfect hexagonal prisms. The prevailing color of the large crystals is a pale bluish green: the smaller crystals are pale yellow, rarely a deep honey, or wax-yellow. At Bowdoinham and Topsham, (Me.) this species is found in veins of graphic granite in small but exceedingly regular crystals, of a pale greenish or yellowish white color. They are mostly imbedded in a brown Quartz; and sometimes present the form of fig. 55. A few crystals of the emerald green color have been met with at Topsham. The Albite granite of Goshen and Chesterfield afford small and irregular crystals of pale green colors, some of which are transparent. In Connecticut at Haddam, large crystals of the yellow and yellowish-green varieties, occur at the chrysoberyl vein, many of which contain implanted crystals of Chrysoberyl and Columbite. A seam of Brown Quartz in a vein of mica slate in the same town, has afforded very beautifully transparent crystals of the form represented in fig. 56: the quarries of gneiss in the neighborhood on both sides of the Connecticut river, produce green prisms of the common variety. At Monroe, a vein of graphic granite furnishes uncommonly handsome crystals as respects their regularity and the number of crystals of different sizes implanted within a small mass of the rock.

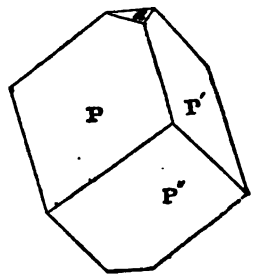
6. Beryl, when clear and transparent, and of a fine emerald green color, is highly valued as a gem: the bluish colored crystals are not so highly prized, but are employed for the same purpose.

BEUDANTITE.

Primary form. Rhomboid. P on P′=92° 30′.

Secondary form.

Fig. 58.



Cleavage parallel with *a*.

Surfaces curved; generally brilliant.

Lustre resinous. Color black; in thin fragments, translucent, and of a deep brown color. Streak greenish-grey.

Hardness = 4·0 . . . 4·75.

Compound varieties. Massive: composition not described.

1. It consists of the oxides of iron and lead.
2. Its locality is Horhausen on the Rhine, where it seems associated with Brown Iron-Ore.
3. The want of a knowledge of the specific gravity of this mineral prevents us from referring it to its natural historical genus. The properties above enumerated, however, prove it with sufficient distinctness to be a peculiar species.

BI-SELENIURET OF ZINC. (See *Rionite.*)

BISMUTH BLENDE. Tetrahedral Bismuth Baryte.

Primary form. Unknown.* Implanted globular shapes. Massive: composition thin columnar, impalpable, also curved lamellar.

* HARTMANN gives the Tetrahedron as the primary form of this species, and describes its crystals as occurring in tetrahedra, with their edges deeply bevelled, and like fig. 55, P. I.

Fracture imperfectly conchoidal or uneven.

Lustre resinous. Color dark hair-brown, yellowish-grey and straw-yellow. Streak yellowish-grey. Translucent or opake.

Rather brittle. Hardness = 3·5 . . . 4·0. Sp. gr. = 5·9 . . . 6·0.

1. It decrepitates briskly before the blow-pipe, emits an arsenical odor, and is finally converted into a glass, which effervesces with borax.

2. *Analysis.*

By Hunefeld.

Carbonate of bismuth	58·8
Arsenic acid	2·2
Silica	23·8
Arsenic, cobalt, copper and iron	5·9
Gangue	9·1

3. It occurs with Quartz at Schneeberg in Saxony.

Bismuthic Cobalt-Ore.

The description of this species, as put forth by Kersten, is too defective to enable us to decide whether it is entitled to rank as a distinct species. It is described as massive, having a lead or steel-grey color, a feebly metallic lustre and a sp. gr. from 6·0 . . . 7·8. It is believed to consist of arsenic, cobalt and bismuth. It occurs with other ores of cobalt at Schneeberg in Saxony.

BISMUTHINE. Prismatic Polypoione-Glance.

Primary form. Right rhombic prism. M on M = nearly 91°.

Secondary form.

Fig. 59.

The lines parallel to the plane *f*, represent the striæ constantly observed on the crystals, but which in reality are a series of planes.

Cleavage parallel to the planes P and *f*, most perfect parallel with the latter, and at right angles to *f*, affording the measurement of 90° by the reflective goniometer. Fracture scarcely observable. Surface of the prisms deeply streaked parallel to the axis.

Lustre metallic. Color lead-grey, inclining a little to steel-grey. Streak unchanged.

Rather sectile. Hardness = 2·0 ... 2·5. Sp. gr. = 6·549.

Compound varieties. Massive: composition granular, the individuals being of various sizes; or columnar, individuals straight and aggregated in various directions.

1. It is volatilized before the blow-pipe, and covers the charcoal with a yellow areola. It is easily fusible, and emits continually small drops in a state of incandescence. It is easily soluble in nitric acid, and the solution yields a white precipitate on being further diluted.

2. *Analysis.*
By Sage.

Bismuth	60·00
Sulphur	40·00

3. It occurs principally in veins, but is also found in beds, and is generally associated with Native Bismuth.

4. It is a rare mineral. Its localities are, Altenberg, Schneeberg, Joachimsthal, Rezbanya, Cornwall, Riddarhyttan in Sweden, Beresof in Siberia, at Canock in Cumberland.

It has been noticed at a single spot in the United States, in the celebrated Chrysoberyl locality of Haddam, (Con.)

BISMUTH-OCHRE. Bismuthic Lusine-Ore.

Massive: composition impalpable; earthy and pulverulent. Fracture conchoidal to earthy.

Color straw-yellow, or greyish yellow.

Soft. Sp. gr.=4·36.

1. Upon charcoal, it is easily reduced to the metallic state, attended by a peculiar odor. It is soluble in nitric acid,—the solution throwing down a white precipitate on the addition of water.

2. *Analysis.*

Oxygen	10·13
Bismuth	89·87

It frequently occurs mixed with carbonate of bismuth and iron.

3. It is found in small quantity upon the ores of bismuth, cobalt and nickel, at Schneeberg in Saxony, Joachimsthal in Bohemia, Saint Agnes in Cornwall, Siberia; and at Haddam, (Con.) in the chrysoberyl rock, where it is sometimes accompanied by Bismuthine.

BITTER-SPAR. (See *Dolomite.*)

BITUMEN. Black Mineral-Resin. MOHS.

Aggregation solid or fluid, and all the intermediate stages. No regular form. Stalactitic shapes: surface smooth. Massive.

Fracture conchoidal, more or less perfect, uneven.

Lustre resinous. Color black, passing into various brown and red tints. Fluid varieties are sometimes perfectly colorless. Streak commonly unchanged, sometimes lighter than the color. Translucent on the edges, opake; some fluid varieties are transparent.

Sectile, malleable, elastic. Bituminous odor. Hardness = 0·0 . . . 2·0. Sp. gr. = 0·828, brown, malleable; 1·073, black, slaggy; 1·160, hyacinth-red, slaggy.

1. *Mineral Oil* and *Mineral Pitch* have been treated as two species; the former embracing under it as varieties Naphtha and Petroleum, and the latter Earthy Bitumen, Elastic Bitumen, and Compact Bitumen or Asphaltum; but all these varieties differ in nothing except their state of aggregation, which, however, forms an uninterrupted series from those which are perfectly fluid to such as are perfectly solid. The Mineral

Oil is first inspissated, and then it is changed into Mineral Pitch by further exposure to the air. Naphtha embraces yellowish and nearly transparent varieties of the fluid Bitumen, while Petroleum consists of those which have the consistence of tar, together with a black color. Elastic Bitumen is distinguished by its elasticity. Earthy Bitumen has an earthy fracture, while Asphaltum possesses a more or less conchoidal fracture. Still, all these varieties are joined by transitions, which proves that they form but a single natural historical species.

2. Mineral oil is easily inflammable, and burns with a white flame and much smoke. Also the Mineral Pitch is very inflammable, and burns with a bituminous smell; some varieties melt in a higher temperature.

3. *Analysis.*

	By Thomson, of Naphtha.	of Elastic Bitumen.
Carbon	82·20	52·25
Hydrogen	14·80	7·49
Azote	0·00	0·15
Oxygen	0·00	40·11

4. The fluid varieties of Bitumen ooze out of several rocks, as sandstone, slaty clay, &c., or they are found on the surface of springs and lakes. The elastic variety is found in limestone rocks along with Galena; the earthy in beds with limestone, but associated with members of the coal formation. The Asphaltum is imbedded in nodules in limestone, in agate balls, in veins with Galena, Fluor, &c.; also in beds, and on the shores and waters of certain lakes.

5. Fluid varieties have been found in various districts of Italy, in Sicily, in Zante, in the Caspian Sea, in Persia and other countries in Asia. Elastic Bitumen (sometimes called mineral *Caoutchouk*) occurs at Castleton in Derbyshire. Earthy Bitumen is found near Neufchatel in Switzerland, at Grund in the Hartz, in Dalmatia, &c. Asphaltum forms nodules in limestone at Bleiberg in Carinthia, in sandstone in Albania, in great abundance in the island of Trinidad, and in large pieces on the shores, or floating on the surface of the Asphaltic lake in Judea, called the Dead Sea.

The United States and the Canadas afford numerous localities of the more fluid and soft varieties of Bitumen. Petroleum occurs on the Kenhawa in Virginia, on a spring of water five miles from Scottsville, Allen co. (Ken.) at several places in the western part of Pennsylvania, at Duck

Creek in Munroe co. (Ohio,) and in Liverpool in the same state, where a salt well, while boring, yielded about fifteen gallons per day. In New York, it is found floating upon the surface of Seneca Lake, and is hence known in commerce under the name of *Genesee* or *Seneca*-Oil. In Woodbury, and some other places in Connecticut, the Elastic Bitumen is found in connexion with a bituminous limestone. The black limestone in the vicinity of Quebec affords exudations of Petroleum.

6. The different varieties of Bitumen allow of considerable application for illuminating, for fuel in fire-works, in the manufacture of varnish and of black sealing-wax. Mingled with grease or common pitch, it is used for paying the bottoms of ships. The ancients employed Bitumen in the construction of their buildings; the bricks of which the walls of Babylon are built are cemented with hot bitumen. The Egyptians are also said to have employed it for the embalming of bodies.

BITUMINOUS COAL. Bituminous Mineral Coal. Mohs.

No regular form or structure. Fracture conchoidal, uneven.

Lustre resinous, more or less distinct. Color black or brown, passing in earthy varieties into greyish tints. Sometimes exhibits tarnished colors. Streak unchanged, except that it sometimes becomes shining. Opake.

Sectile, in different degrees. Hardness $=1{\cdot}0\ldots2{\cdot}5$. Sp. gr. $=1{\cdot}223$, moor-coal from Teplitz; $=1{\cdot}270$ common brown coal from Eibiswald in Stiria; $=1{\cdot}271$, black coal from Newcastle; $=1{\cdot}288$, bituminous wood; $1{\cdot}423$, cannel coal from Wigan in Lancashire.

Compound Varieties. Massive: composition lamellar, faces of composition smooth and even, different gradations; granular texture often impalpable, in which case fracture is uneven, even or flat conchoidal. Ligniform shapes, the structure of which resembles that of wood, sometimes very distinct, but often obliterated, with the exception of some

slight traces, when the fracture becomes conchoidal across the fibres. There are some earthy varieties of a loose friable texture.

1. The present species is treated by some writers as forming four separate species: viz. *Brown Coal, Black Coal, Cannel Coal* and *Jet;* and the two first mentioned varieties have been again divided into several sub-species. The color of Brown Coal is brown, as its name imports. It possesses a ligneous structure, or consists of earthy particles. Its varieties are as follows: *Bituminous Wood,* which presents a ligneous texture, and very seldom any thing like a conchoidal fracture, and is without lustre; *Earthy Coal,* consisting of loose friable particles; *Moor Coal,* or *Trapezoidal Brown Coal,* distinguished by the want of ligneous structure, and by the property of bursting and splitting into angular fragments, when removed from its original repository; *Common Brown Coal,* which, though it still shows traces of ligneous texture, is of a more firm consistency than the rest of the varieties, and possesses higher degrees of lustre upon its more perfect conchoidal fracture. The color of *Black Coal* is black, without inclining to brown, and it is destitute of the ligneous texture. Some of its varieties immediately join those of Brown Coal. They are: *Pitch Coal,* of a velvet black color, generally inclining to brown, strong lustre, and presenting in every direction a large and perfect conchoidal fracture; *Slate Coal,* possessing a more or less coarse, slaty structure, which, however, seems to be rather a kind of lamellar composition, than real fracture; *Foliated Coal,* which is similarly compounded, only the laminæ are thinner; *Coarse Coal* has a composition resembling it, only the component particles are smaller, and approach to a granular appearance. *Cannel Coal* is without visible composition, and has a flat conchoidal fracture in every direction, but with little lustre, by which it is distinguished from Pitch Coal. It most resembles the Moor Coal, but the difference in their specific gravity is greater than between almost any other two varieties of coal. Jet occurs in elongated reniform masses, and sometimes in the shape of branches with a regular woody structure. Its lustre is brilliant, and its fracture perfectly conchoidal. All these kinds, however, are united by numerous transitions, so that it continually becomes doubtful to which of them we should refer certain specimens, though thoy are undoubtedly Bituminous Coal.

2. Bituminous Coal is more or less easily inflammable, and burns with flame and a bituminous smell. Several varieties become soft, and others

coak when kindled. They have a more or less considerable earthy residue.

3. *Analysis.*
By THOMSON.

	Newcastle or caking coal.	Cannel Coal.
Carbon	75·28	64·72
Hydrogen	4·18	21·56
Azote	15·96	10·72
Oxygen	4·58	0·00

4. The varieties called slate coal, foliated coal, and pitch coal, occur chiefly in the coal formation; some varieties of pitch coal, also the moor coal, bituminous wood, and common brown coal, are met with in the formations above the chalk; the earthy coal, and some varieties of bituminous wood and common brown coal, are often included in diluvial and alluvial detritus. The coal seams alternate with beds of slaty clay and common clay, sandstone, limestone, sand, &c. They are often associated with vegetable organic remains in slaty clay, sometimes also with shells. Generally there is more or less Iron Pyrites and White Iron Pyrites mingled along with them, and they are sometimes traversed by veins of Galena.

The present species is so universally distributed, that only a few localities can here be mentioned as examples. Bituminous wood is found in considerable quantity in Iceland, and is called *Surturbrand;* in the Meissner mountain in Hessia, in the Westerwald, at Voitsbey in Stiria, and at Bovey in Devonshire. Earthy coal is found at Merseberg, Halle, Bernburg, and at Eislben in Thuringia. Moor coal occurs in the northern districts of Bohemia. Common brown coal occurs in immense quantities on the river Sau, and on the foot of the Schwaneberg Alps. Pitch coal is likewise found in the Meissner, in Saxony, Silesia, on the Rhine, and in France. Slaty coal occurs at Potschappel in Saxony, in Silesia, in Westphalia, and particularly at Newcastle, White haven, and other places in England and Scotland. *Paper Coal,* which occurs in thin paper-like seams, is found in Saxony and Sicily. Cannel coal exists abundantly in Lancashire and Shropshire in England and in Scotland. Jet is brought from the Prussian amber mines, and is met with at a considerable depth, between beds of sandstone, at several places in France.

Bituminous Coal exists in the greatest quantity throughout extensive portions of the States of Pennsylvania, Virginia and Ohio. From Gallipolis to the Falls of the Ohio, coal of the best quality may be bought for

ten cents the bushel; and at Pittsburg, where it is most abundant, its price is six cents the bushel. According to Maclure, the independent coal formation extends from the waters of the Ohio to the waters of the Tombigbee. The coal of this region is chiefly a very pure slate coal; and is often beautifully tarnished with the richest iridescence. At some places upon the Ohio, however, extensive deposits of the purest pitch coal are found. The secondary region of the Connecticut river affords occasionally traces of Bituminous Coal, not only in its sandstones and slates, but in its trap; but is no where likely to be found in sufficient quantity to be explored.

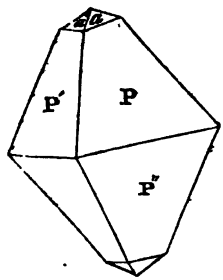
5. The important uses of this species for fuel are well known. Cannel coal and jet are wrought for ornamental purposes.

BLACK MANGANESE. Pyramidal Manganese-Ore. Mohs.

Primary form. Octahedron with a square base. P on P″=117° 30′.

Secondary form.

Fig. 60.



a on *a* - - - 139° 56′

Cleavage, parallel to the base of the primary form perfect; less distinct and interrupted parallel with the octahedral faces.

Fracture uneven.

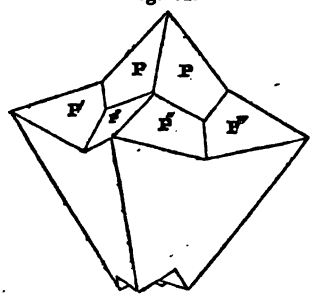
Lustre imperfect metallic. Color brownish black. Streak dark reddish or chesnut-brown. Opake.

Black Manganese.

Hardness = 5·0 . . . 5·5. Sp. gr. = 4·722 of a crystallized variety.

Compound Varieties. Twin crystals. Common octahedral hemitrope; also repeated a second time,

Fig. 61.



Massive: composition granular, firmly connected.

1. Before the blow-pipe on charcoal, in a strong heat, it fuses on the edges and assumes a blackish-grey color. With borax, it is easily dissolved, giving in the exterior flame an amethystine blue color, and in the interior a feeble tinge of iron. With salt of phosphorus, it dissolves rapidly with effervescence, and attended with a deep blue color, which disappears in the reduction-fire of the instrument.

2. *Analysis.*

It is not absolutely certain that the Black Manganese has as yet been subjected to analysis, although it is extremely probable that the variety of Manganese from Piedmont, analysed by BERZELIUS, belongs to this species. It consisted of

Oxide of manganese	75·80
Silica	13·17
Oxide of iron	4·14
Alumina	2·80

3. It has been found in veins in porphyry, along with other ores of manganese, at Ochrenstock, near Ilmenau in Thuringia, and at Ihlefeld in the Hartz. In the United States, it occurs at Lebanon, (Penn.) It is yet a rare substance.

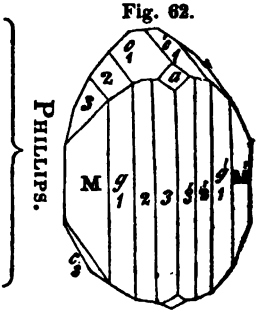
BLACK SILVER. Prismatoidal Polypoione-Glance.

Primary form. Right rhombic prism. M on M′=100° 0′. The dimensions of the primary form, however, cannot be considered as fixed, since LEONHARD and HARTMANN describe crystals of this species, which appear to have a primary form of 107° 47′.

Secondary forms.

M on M′	-	100°	0′
M or M′ on *a* or *a*′		135	15
M on *c*1	-	110	0
M on *g*1	-	170	10
M on *g*2	-	160	30
M on *g*3	-	146	30
a on *c*1	-	120	12
a on *c*2	-	145	24
a on *c*3	-	143	25
*c*3 on *c*3	-	122	15

Fig. 62.

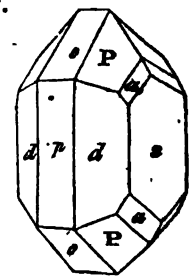


Himmelsfurst mine, Freiberg.

d on *d* over *p* - 72° 13′ HARTMANN.

p, *s* and *o* are tangent planes.

Fig. 63.



Przibram, Bohemia.

The mutual inclinations of the pyramidal faces P, which correspond to the lateral edges of the primary form, are 130° 16′ and 104° 19′. It also occurs in crystals, destitute of the faces *o* *p* and *a*.

Cleavage parallel to M and M′ easy, and in other directions, of the variety from Freiberg. The variety from Przibram has indistinct cleavages.

Black Silver.

Surface of the prisms striated vertically.

Lustre metallic. Color iron-black. Streak unchanged. Sectile. Hardness =2·0 . . . 2·5. Sp. gr. =6·269 from Przibram; =5·5, from Freiberg.

Compound Varieties. Twin-crystals like those of Aragonite. (q. v.) Massive: composition granular, individuals strongly connected; fracture uneven.

1. Before the blow-pipe, upon charcoal, it yields a dark colored metallic globule, which may be reduced either with soda and silver, or with nitre. It is soluble in dilute nitric acid.

2. *Analysis.*

	By Klaproth.	By Brandes, from Freiberg.
Silver	66·50	65·50
Antimony	10·00	0·00
Arsenic	0·00	3·30
Iron	5·00	5·46
Sulphur	12·00	19·40
Copper and arsenic	0·50	0·00
Copper	0·00	3·75

3. Black Silver occurs in silver-veins along with other ores of silver, also with Galena, Blende, Copper and Iron Pyrites, Heavy Spar, &c. It is sometimes associated with Native Arsenic and Native Gold. Its compact varieties are often intimately mixed with Galena and with Stibine,—a mixture designated by the name of *White Silver*, the *Weissgeltigerz* of Werner. The richer it is in silver, the more it approaches in its properties to the pure varieties of Black Silver; while in the contrary cases, it presents more nearly the characters of compact Galena and of compact Stibine, or of a mixture of both. It occurs in the silver veins of Saxony.

4. Black Silver is found chiefly in Saxony, Bohemia and Hungary; in the last of which countries it is called Röschgewächs. Its chief localities in Saxony are the mining districts of Freiberg, Schneeberg, and Johanngeorgenstadt; in Bohemia, those of Przibram and Ratieborzitz; and in Hungary those of Schemnitz and Cremnitz. It is found also in small quantities in Andreasberg in the Hartz; and at Zacatecas in Mexico, and in Peru, as well as in Siberia.

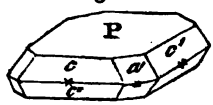
5. On account of the large proportion of silver which it contains, it is a valuable ore for the extraction of that metal.

BLACK TELLURIUM. Prismatic Polypoione-Glance.

Primary form. Right square prism.

Secondary form.

Fig. 64.



x on x	-	-	90°	00′	c. g.	PHILLIPS.
x on x'	-	-	135	00	c. g.	
P on a	-	-	118	35		
P on c	-	-	110	00	c. g.	

Cleavage parallel with P, perfect.

Fracture not observable.

Surface P smooth.

Lustre metallic. Color blackish lead-grey. Streak unchanged.

Highly flexible in thin laminæ. Very sectile. Hardness = 1·0 . . . 1·5. Sp. gr. = 7·085.

Compound varieties. Massive: composition granular, of various sizes of individuals, sometimes longish.

1. Before the blow-pipe, upon charcoal, it melts easily, emits white fumes, which are deposited upon the charcoal, and gives a metallic globule. With borax, it gives a bead of gold containing a little silver. It is easily soluble in nitric acid.

2. *Analysis.*
By KLAPROTH.

Tellurium	32·20
Lead	54·00
Gold	9·00
Silver	0·50
Copper	1·30
Sulphur	3·00

Blende.

3. It has been found only in veins with Native Gold, Galena, Blende and Carbonate of Manganese.

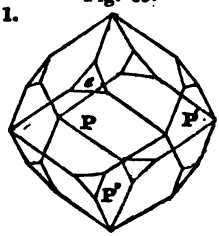
4. Its chief locality is Nagyag in Transylvania, from whence it obtained its old name of *Nagiaker-Erz*. It is found also with Graphic Tellurium at Offenbanya in the same country.

BLENDE. Dodecahedral Sclerone-Blende.

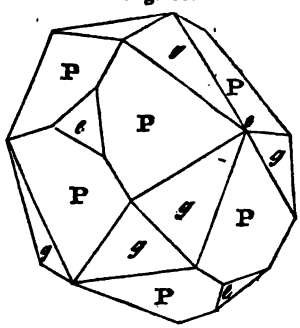
Primary form. Rhombic dodecahedron.

Secondary forms.

1. Fig. 65.



2. Fig. 66.

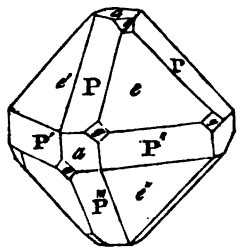


Four of the obtuse solid angles are replaced by tangent planes, while the remaining four are unaltered, except that they are formed from six instead of three plane angles, as may be seen in the angle at *o*.

P on *e* - - -	144° 44′ 08″	HAUY.
g on *g* - - -	129 31 18	

Blende.

3. Fig. 67.



P on *a*	-	-	135°	00′	00″	Hauy.
a on *e*	-	-	125	15	52	
c on *c*	-	-	109	18	16	

4. Dodecahedron with the obtuse solid angles deeply truncated, so as to give rise to an octahedron with its edges replaced by tangent planes. (fig. 62. P. I.)

5. Regular octahedron.

6. Tetrahedron.

7. Regular octahedron with its edges and angles replaced by tangent planes.

8. Cube.

9. Tetrahedron with its angles replaced by tangent planes.

10. Tetrahedron with its angles replaced by three planes resting on its edges. (fig. 55. P. I.)

Cleavage parallel to the primary faces, perfect.

Fracture conchoidal. Some yellow varieties are phosphorescent by friction.

Lustre adamantine. Color green, yellow, red, brown, black, none of these bright. Streak white to reddish-brown, corresponding to the color. Transparent... translucent.

Blende.

Brittle. Hardness = 3·5 . . . 4·0. Sp. gr. = 4·078, a cleavable variety; =4·027, a columnar, compound variety.

Compound Varieties. Twin-crystals. Octahedral hemitrope. (fig. 50.) This composition is repeated, as in fig. 61, and sometimes for a number of times. Reniform and other imitative shapes: surface rough; composition columnar, often almost impalpable; straight, divergent, and frequently producing a second curved lamellar or granular composition. Massive: composition columnar, or granular, sometimes impalpable, often very distinct. The fracture of impalpable compositions is uneven or even.

1. Although the subspecies distinguished by the earlier writers on mineralogy among the varieties of Blende, have been denominated after their colors, yet they do not depend entirely or solely upon these colors. *Yellow Blende* includes the more transparent varieties, whether of a green, yellow or reddish-brown color. *Brown Blende* consists of the more opake red and brown varieties. *Black Blende* is either black and opake, or blood-red. Brown Blende has been further divided into *foliated*, *radiated* and *fibrous* brown Blende: simple varieties and compound ones, consisting of granular individuals, are contained in the first of these divisions; columnar compositions, in which the individuals are still discernible in the second; and very thin columnar or impalpable compositions originating from them, which assume various imitative shapes, are comprehended in the third division. The exact distinction of the above varieties, requires much practice, and can be acquired only empirically; and even then many varieties will occur that render the distinction impossible, which is proof that the distinction itself is useless.

2. When strongly heated in the oxidating flame of the blow-pipe, it gives off vapors of zinc, which form a coating on the charcoal, but it does not melt. It is soluble in nitric acid, during which process sulphuretted hydrogen is evolved.

3. *Analysis.*

	By Thomson.	By Guenniveau.
Zinc	59·09	62·00
Iron	12·05	1.50
Sulphur	28·86	34·00

4. Blende is an abundant and widely diffused ore; but all its varieties are not equally common. It is found in beds and veins, accompanied by Galena, Copper Pyrites, Heavy Spar, Fluor, Spathic Iron, &c. It also occurs in silver veins associated with Native Silver and other ores of that metal.

5. Yellow Blende principally occurs in fine varieties at Schemnitz in Lower Hungary, and at Kapnick in Transylvania; also in Saxony, at Ratieborzitz in Bohemia, at Gummesud in Norway, and other places. Brown Blende is found at Freiberg and other localities in Saxony, Bohemia, the Hartz, Sweden, and in great quantities in Derbyshire, Cumberland and Cornwall in England. The radiated variety, in particular, is found at Przibram; it is this variety in which STROMEYER detected the metal Cadmium. The fibrous Blende occurs at Geroldseek in the Brisgau, and at Raibel in Carinthia. Black Blende comes from Freiberg, Annaberg, Breiten brunn, and Schwarzenberg in Saxony, and many places in Bohemia, Hungary, Silesia and other European countries.

The localities of Blende in the United States are very numerous; a few of these only therefore can be indicated. The yellowish-brown foliated variety is found abundantly along with Galena at North and South Hampton, (Mass.); the black Blende occurs at Monroe, (Con.) associated with Wolfram, Tungsten, Native Bismuth and Arsenical Iron; the yellow Blende in transparent crystals is met with occasionally throughout the secondary limestones of New York and Ohio. The Missouri lead mines, and the Perkiomen lead mine near Philadelphia, abound with the present species.

BLOEDITE.

Crystalline. Primary form unknown. Massive: imperfectly foliated, and stalactitic. Fracture uneven.

Color between flesh and brick red.

Taste sharp bitter and astringent. Becomes moist in the air.

1. *Analysis.*

By JOHN.

Sulphate of soda	33·34
Sulphate of magnesia	36·66
Sulphate of manganese	0·33
Sulphate of iron	0·34
Chloride of sodium	0·33
Water	22·00

Blue Malachite.

2. It is found in the salt mines of Ischel in Lower Austria.

3. The foregoing description is too inadequate to pronounce upon the specific character of Bloedite. If it shall prove to be a new species, it will probably take its systematic place within the genus Glauber-Salt.

4. Under this mineral must be included the *Sulphate of soda and magnesia of Schemnitz*, which occurs in little crystalline fibres or needles, that appear to be rhombic prisms. It is not efflorescent like the Glauber-Salt.

According to BEUDANT, it contains

Sulphuric acid	44·7
Soda	17·6
Magnesia	11·4
Water	25·4
Earthy matter	0·9

5. The *Reussine* of KARSTEN may also be introduced here, until something further is determined respecting its properties. It occurs in six-sided acicular crystals, which probably come from a rhombic prism: also in flakes. Fracture conchoidal. Taste bitter, astringent. It consists of

Sulphate of soda	66·04
Sulphate of magnesia	31·35
Sulphate of lime	0·42
Chloride of magnesium	2·19

According to BEUDANT, the Reussine is a mixed mineral, consisting of effloresced Glauber-Salt and small crystalline particles of the double salt of sulphate of soda and magnesia.

BLUE MALACHITE. Azure Copper-Baryte.

Primary form. Oblique rhombic prism. M on M′ = 98° 50′.

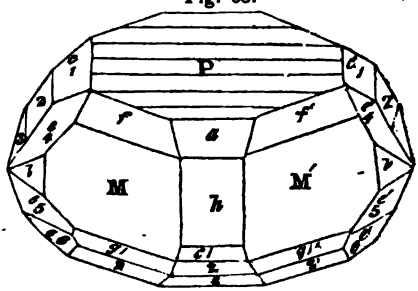
Secondary forms.

1. Primary form. 2. Primary form, having the obtuse terminal edges replaced by single planes. (fig. 95. P. I.) 3. Primary form, having both the obtuse and acute terminal edges replaced by single planes. 4. Form 2d, with the oblique edges of the prisms replaced by tangent planes. 5. Form 2d, with the lateral solid angles replaced by sin-

Blue Malachite.

gle planes. 6. Form 4th, with lateral solid angles replaced by single planes.

Fig. 68.



P on M or M′	91°	30′	PHILLIPS.	M on $g1$ or M′ on $g'1$	142	56
M on M	98	50		M on $g2$ or M′ on $g'2$	131	4
P on a	135	15		M on h or M′ on h'	139	15
P on $e1$ or $e'1$	149	20		M on l or M′ on l'	179	26
P on $e2$ or $e'2$	138	12		a on f or f'	139	30
P on $e3$ or $e'3$	119	30		a on h	136	45
P on $e4$ or $e'4$	115	30		$e1$ on $e2$	169	2
P on f or f'	112	15		$e1$ on $e4$	141	6
P on h	92	15		$e1$ on f	129	00
M or M′ on a	123	40		$e3$ on $e3'$ over P	120	30
M on $e1$ or M′ on $e'1$	111	5		$e3$ on $e5$	157	5
M on $e2$ or M′ on $e'2$	116	55		$g1$ on $g2$	168	15
M on $e4$ or M′ on $e'4$	149	5		$g1$ on $e6$	164	24
M on $e5$ or M′ on $e'5$	156	5		h on $c1$	154	4
M on $e6$ or M′ on $e'6$	138	30		h on $c2$	134	55
M on f or M on f'	159	50		h on $c3$	115	00

Cleavage parallel to M and M′ perfect; parallel to P very difficult. Cleavage may be effected also parallel with both diagonals of the primary form.

Surface of P striated in the direction of the longer diagonal.

Lustre vitreous, almost adamantine. Color various shades of azure-blue, passing into blackish blue and berlin-blue. Streak blue, lighter than the color. Transparent... translucent on the edges.

Blue Malachite.

Brittle. Hardness = 3·5.... 4·0. Sp. gr. = 3·831, crystals from Chessy.

Compound Varieties. Globular, reniform, botryoidal, stalactitic shapes, implanted and imbedded; surface drusy and rough; composition columnar, more or less perfect and distinct, faces of composition rough. Massive: composition columnar, more rarely granular. Sometimes in an earthy state.

1. Blue Malachite is soluble with effervescence in nitric acid, becomes black if exposed alone to high degrees of temperature, melts upon charcoal, and colors glass of borax green in the oxidating flame.

2. *Analysis.*

	By Klaproth.	By Vauquelin.
Copper	56·00	56·00
Oxygen	14·00	12·50
Carbonic acid	24·00	25·00
Water	6·00	6·50

3. It is met with in veins and beds, included in rocks of different ages. It is generally accompanied by Green Malachite and some other ores of copper. Occasionally it is so intimately connected with Green Malachite, that crystals of the form of the Blue Malachite consist entirely, or at least with only the exception of a thin film on the surface of the delicate green fibres, of Green Malachite. It is often engaged in ochrey varieties of Limonite, and associated with White Lead-ore, Galena and Cobalt-bloom.

4. The most beautifully crystallized varieties are found in a bed in secondary mountains at Chessy near Lyons in France. Fine crystals are brought from Siberia. Very delicate, but small crystals, are found at Oravitza in the Bannat. Blue Malachite occurs also in Thuringia, Hessia, the Hartz, Silesia, Tyrol, Spain, Chili, Peru, and at several places in England and Scotland.

The United States afford no very interesting deposits of this species. The best specimens are found in Pennsylvania at the Perkiomen lead mine, where it occurs in small crystals along with Galena, Blende and White Lead-Ore.

Blue Spar.

BLUE SPAR. Prismatoidal Azure-Spar. MOHS.

Primary form. Doubly oblique prism? of unknown dimensions.

Cleavage indistinct, sometimes pretty obvious in one direction, with traces in other directions, making oblique angles with the easily observed cleavage. Massive. Composition granular, often in large individuals; strongly coherent. Fracture uneven, often splintery.

Lustre vitreous, slightly inclining to pearly upon faces of cleavage. Color smalt-blue, inclining sometimes to white and green. Streak white. Translucent on the edges, often nearly opake.

Brittle. Hardness = 5·5 . . . 6·0. Sp. gr. = 3·024.

1. Before the blow-pipe it loses its color, but does not melt. It is slowly and with difficulty dissolved in borax. With boracic acid and iron-wire, it yields a globule of phosphuret of iron.

2. *Analysis.*

By R. BRANDES.

Phosphoric acid	43·32
Silica	6·50
Alumina	34·50
Magnesia	13·56
Lime	0·48
Protoxide of iron	0·80
Water	0·50

3. It occurs in masses, sometimes six or eight inches over; also in large indistinct crystals imbedded in Quartz and mixed with Mica. The rock embracing it, however, has no where been found in place.

4. It is found in the valley of Freschnitz near Krieglach, on the Mürz in Upper Stiria; also at Therenberg at the foot of the Wechsel mountain in Lower Austria.

5. The near agreement of Blue Spar with Sodalite in hardness and specific gravity, and the want of certainty in our knowledge respecting the system of crystallization to which Blue Spar belongs, render it possible that the two substances may hereafter be shown to be identical.

Blue Vitriol.

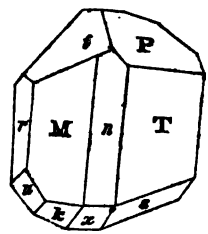
BLUE VITRIOL. Tetarto-Prismatic Vitriol-Salt. MOHS.

Primary form. Doubly oblique prism. P on M 127° 30′. P on T 108°. M on T 123° 10′.

Secondary form.

M on T	-	-	123°	10′
r on M	-	-	126	40
r on T	-	-	110	10
r on *n*	-	-	100	41
r on P	-	-	103	27
n on P	-	-	120	50
P on T	-	-	127	40
i on *r*	-	-	139	13
K on *n*	-	-	109	38
K on *r*	-	-	114	57
s on *n*	-	-	92	26
s on *r*	-	-	139	43

Fig. 69.



Cleavage very imperfect. Fracture conchoidal. Surface: the faces *n* commonly deeply striated parallel to their edges of combination with M and T, which faces are also sometimes striated, though not so generally as *n*.

Lustre vitreous. Color sky-blue, in different shades, commonly deep. Streak white. Semi-transparent ... translucent.

Rather brittle. Hardness = 2·5. Sp. gr. = 2·213.

Taste astringent and metallic.

1. It is easily soluble in water, and gives a blue solution: a polished surface of iron when immersed in this solution is covered with a film of metallic copper.

2. *Analysis.*

By BERZELIUS.

Oxide of copper . . .	32·13
Sulphuric acid . . .	31·57
Water . . .	36·30

3. Blue Vitriol owes is existence to the decomposition of Copper Pyrites; and is found dissolved in water issuing from mines, and which has received the name of *Water of Cementation*. From this, it deposits itself spontaneously in certain places, and presents itself in large masses, occasionally associated with other ores.

4. Its chief localities are the Rammelsberg near Goslar, Neusohl in Hungary, Anglesey in the Pary's mine, Cornwall at the Consolidated mines, and at the copper mines in Wicklow, Ireland. Its occurrence may be expected at the copperas mine in Stafford, (Vt.)

5. As it occurs in nature, it requires first to be purified, before it can be employed in the arts, where it is used in dyeing, in printing of cotton, linen, &c. The oxide of copper, separated from its acid, is likewise used in painting.

BOLTONITE. Parachrose Tabular-Spar.

Massive. Composition granular: individuals large. Cleavage in one direction pretty distinct, in two others oblique to the first, indistinct, but affording indications of a doubly oblique prism for the primary form. Fracture uneven or small conchoidal.

Lustre vitreous. Color bluish grey, yellowish grey, wax yellow to yellowish white. The darker colors change to yellow on exposure to the weather. Streak white. Transparent or translucent.

Hardness = 5·0 . . . 6·0. Sp. gr. = 2·8 . . . 2·9.

1. This mineral when first discovered was regarded as Pyrallolite. It is believed to be identical with the substance described by Dr. Thomson, (Ann. Lyc. Nat. Hist. of N. York, Vol. III. p. 50,) under the name of Bisilicate of Magnesia; and accordingly the analysis there given is here quoted.

2. Alone before the blow-pipe, it becomes white and transparent, but does not melt. With borax, it dissolves slowly into a transparent glass.

3. *Analysis.*

By Thomson.

Silica	56·64
Magnesia	36·52
Alumina	6·07
Protoxide of iron	2·46

4. Boltonite occurs thickly disseminated through white limestone, associated occasionally with Petalite.

5. It is found abundantly at Bolton, (Mass.) and has also been detected in the neighboring quarries of Boxborough and Littleton.

BOMBITE.

Massive: composition impalpable.

Color bluish black.

Hardness = 7·5.

1. Fusible before the blow-pipe with ebullition into a yellowish glass.

2. *Analysis.*

By LAUGIER.

Silica	50·0
Alumina	10·5
Oxide of iron	25·0
Magnesia	3·5
Lime	0·5
Carbon	3·0
Sulphur	0·3

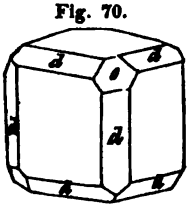
3. Its geological situation is unknown. It has been found only in Bombay. It appears to be a variety of flinty-slate.

BORACITE. Tetrahedral Boracite. MOHS.

Primary form. Cube.

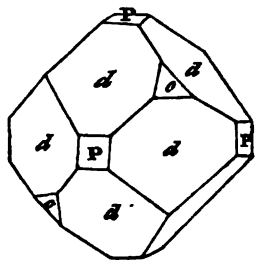
Secondary forms.

Fig. 70.



Segeberg Holstein.

Fig. 71.



Lüneberg.

Cleavage, traces parallel to the faces of the octahedron. Fracture conchoidal, uneven.

Boracite—Borax.

Lustre vitreous, inclining to adamantine. Color white, inclining to grey, yellow and green. Streak white. Semi-transparent, translucent.

Hardness = 7·0. Sp. gr. = 2·974 of an isolated crystal.

1. Before the blow-pipe, on charcoal, it intumesces, and melts into a glassy globule, which becomes white and opake on cooling. It is electric by heat, four alternating terminal points of its cubic axes being positive, and those which are opposite to them, negative.

2. *Analysis.*

By Pfaff.

Boracic acid	54·55
Magnesia	30·68
Oxide of iron	0·57
Silica	2·27

3. Boracite is found in remarkably distinct crystals, about the size of a pea and under, imbedded in compound varieties of Gypsum, and rarely in Anhydrite.

4. The only known localities are Lüneberg in Brunswick and Segeberg in Holstein.

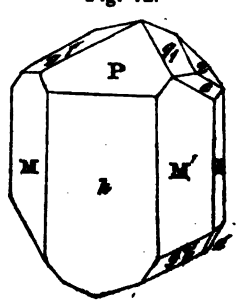
BORAX. Prismatic Borax-Salt. Mohs.

Primary form. Oblique rhombic prism. M on M′ 93° 30′.

Secondary form.

P on M or M′	-	101°	30′
M or M′ on *h*	-	133	20
M on *k*	-	136	45
M on *e*	-	138	12
P on *h*	-	106	30
P on *g*1	-	139	15
P on *g*2	-	115	30
P on *e*	-	114	28
e on *g*2	-	141	52

Fig. 72.



Cleavage parallel to M and M′ perfect, also to both the diagonals of the primary form. Fracture conchoidal.

Lustre resinous. Color white, inclining to grey and green. Streak white. Transparent . . . translucent.

Rather brittle. Hardness = 2·0 . . . 2·5. Sp. gr. = 1·716. Taste sweetish alkaline, feeble.

1. It is soluble in water; the solution changes vegetable blues to green. It intumesces before the blow-pipe, and then melts into a transparent globule.

2. *Analysis.*

Soda	16 7
Boracic acid	36·4
Water	46·9

3. Borax occurs in different districts of Persia and Thibet, where it is found on the surface of the soil, in the vicinity, and sometimes at the bottom, of several lakes, and in a state of solution in the waters of mineral wells. It is found also in Ceylon and at Potosi.

4. The natural salt is employed in manufacturing the artificial one by the addition of a greater quantity of soda. The artificial salt is made use of as a flux, in the production of imitation gems, and in the process of soldering.

5. The natural historical properties above described apply to the manufactured salt: concerning the natural salt but little is known, although perfect crystals of the form here figured are sometimes found among it. In general, it is understood, that it is found mingled up with Common Salt and some excess of boracic acid. The locality in Thibet, which is 15 days from Tisvolumbo, the capital, is a lake supplied by springs, the waters of which contain both borax and common salt. The edges and shallows of this lake are covered with a stratum of Borax, which is dug up from time to time, and the holes thus made are gradually filled by a fresh deposition.

BORNITE. Bismuthic Polypoione-Glance.

Primary form. Rhomboid. Angles not determined.

Cleavage perfect parallel with the primary form.

Lustre metallic. Color pale steel-grey.

Elastic. Not particularly sectile. Soft. Sp. gr. = 8·0,

1. Before the blow-pipe it melts very easily into a globule, that can be entirely volatilized, during which the supporting charcoal is covered with yellow oxide. If dissolved in the state of powder in nitric acid, a precipitate of sulphur is formed.

2. *Analysis.*

	By KLAPROTH.	By WEHLE.
Bismuth	95·01	61·15
Sulphur	5·00	2·33
Tellurium		29·74
Silver		2·07

3. It has been found at Deutsch-Pilsen in Hungary, accompanied by several species of the genus Lime Haloide, Iron Pyrites, &c.

4. Other varieties have been examined from different localities, which require to be mentioned in this place. One from Hungary, for example, has the following properties:

It occurs in imbedded masses, having a general resemblance to 3 and 6 sided prisms. Cleavage perfect in the direction of the bases. Fracture imperfectly conchoidal, uneven, scarcely perceptible. Lustre metallic. Color intermediate between tin-white and steel-grey. Streak unchanged or rather darker; its place becomes shining in the mineral. Opake. Very sectile. Thin laminæ perfectly flexible. Hardness = 1·5. Sp. gr. = 7·408. Before the blow-pipe it gives the reactions of sulphur, tellurium and bismuth. It occurs accompanied by Native Gold and Yellow Copper Pyrites, imbedded in Quartz, at Schemnitz. It contains according to WEHLE,

Bismuth	59 84
Tellurium	35·24
Sulphur	4·92

5. Another variety, examined by BERZELIUS, which had been communicated to him by WEISS of Berlin, was found to contain only tellurium and bismuth.

BOTRYOGENE. Paratomous Vitriol-Salt.

Primary form. Oblique rhombic prism. M on M = 119° 56′.

Cleavage distinct in the direction of M and M′.

Lustre vitreous. Color hyacinth-red. Streak yellow and shining. Translucent.

Hardness =2·0...2·5. Sp. gr. =2·039.

Compound Varieties. Reniform and botryoidal shapes; the individuals are often regularly terminated at the surface of these shapes. Color ochre-yellow.

1. Before the blow-pipe, in a glass tube, it intumesces, and gives off water, leaving a reddish yellow earth behind. It is very slowly soluble in water, to which it imparts a much more feebly astringent taste than sulphate of iron.

2. *Analysis.*

By Berzelius.

Sulphate of iron	48·3
Sulphate of magnesia	20·8
Water	30·9

3. It is found coating Gypsum and Iron Pyrites, associated with Epsom salt and Copperas in the great copper mine at Fahlun.

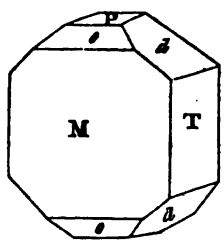
Botryolite. (See *Datholite.*)

BOURNONITE. Diprismatic Copper-Glance. Mohs.

Primary form. Right rectangular prism.

Secondary forms.

Fig. 73.



P on *d*	-	-	-	93°	40′
P on *o*	-	-	-	87	8

Cleavage distinct parallel with M and T, and with both diagonals of the prism. Fracture conchoidal, uneven.

Bournonite.

Surface nearly equal, often highly smooth and splendent: longitudinal striæ sometimes visible on the secondary planes, replacing the lateral edges of the prism.

Lustre metallic. Color steel grey, inclining to blackish lead grey or iron black, according to the physical quality of the surface. Streak unchanged.

Brittle. Hardness $=2{\cdot}5 \ldots 3{\cdot}0$. Sp. gr. $=5{\cdot}763$.

Compound Varieties. Twin-crystals: axis of revolution perpendicular, face of composition parallel to M, or the broader face of the primary form. The individuals are generally continued beyond the face of composition. The axes of the individuals cross each other at angles of 93° 40′ and 86° 20′. Massive: composition granular; individuals strongly connected.

1. Before the blow-pipe, it generally decrepitates, emits a white sulphureous vapor; after which there remains a black globule, consisting of a crust of sulphuret of lead, within which is a mass of copper. It is easily soluble in heated nitric acid.

2. *Analysis.*

	By Hatchett.	By Klaproth.
Antimony	24·23	20·769
Lead	42·62	42·50
Copper	12 80	11·75
Iron	1·20	5·00
Sulphur	17·00	18·00

3. Bournonite is found in veins, associated with Stibine, Galena, and Blende.

4. It was first found in the parish of Endellion, Cornwall, at Huel Boys. Another locality, very early known, was Kapnik in Transylvania. It is now known to exist at Neudorf, in Anhalt, in large and magnificent crystals; also at Andreasberg in the Hartz. Still other deposits of this ore are Braünsdorf in Saxony, Neusohl in Hungary, and Offenbanya in Transylvania.

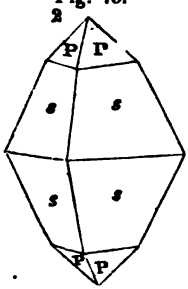
BRAUNITE. Brachytypous Manganese-Ore. HAIDINGER.

Primary form. Octahedron with a square base. P on P over the base, 108° 39′.

Secondary forms.

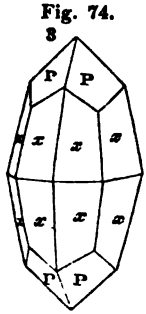
1. Primary form, with the summits replaced by tangent planes. Wunsiedel, Bayreuth.

Fig. 75.



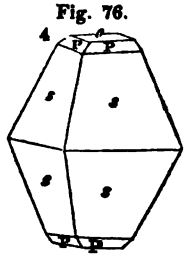
Elgersburg.

Fig. 74.



St. Marcel, Piedmont.

Fig. 76.



Wunsiedel.

s on *s* over the summit	- -	96° 33′
s on *s* at the base	-	140° 30′
P on *x* and *x*, alternately	-	144° 4′ and 128° 17′
x on *x* at the base	-	154° 25′

Cleavage very distinct parallel with the primary faces. Fracture uneven. Surface *o* possesses less lustre than P, but is even, and sometimes faintly streaked parallel to the edges of combination with P. Primary faces often a little rounded; faces *s* uneven, rough, and horizontally streaked; faces *x* smooth and even.

Lustre imperfectly metallic. Color dark brownish black. Streak of the same color.

Brittle. Hardness = 6·0 . . . 6·5. Sp. gr. = 4·818.

Compound Varieties. Massive: composition granular individuals strongly coherent.

1. *Analysis.*
By TURNER.

Protoxide of manganese	86·940
Oxygen	9·851
Water	0·949
Baryta	2·260
Silica	a trace.

2. It is yet a rare mineral, having been brought only from a few places in Thuringia, (Elgersburg, Ehrenstock and Friedrichsrode,) and from Wunsiedel in the Bayreuth.

BREISLAKITE.

Acicular and capillary crystals; bent and grouped like wool. Color reddish, or chesnut brown.

1. Nitric acid, when heated, reduces it to a most impalpable powder of a yellow color. In the flame of a lamp, the crystals suffer no change; but before the blow-pipe they melt into a black enamel. It gives with salt of phosphorus a green globule in the oxidating flame, which becomes red in the reducing flame of the blow-pipe, thus indicating a considerable quantity of copper.

2. *Analysis.* Dr. WOLLASTON is said to have made a chemical examination of this species; the result of which was, that it consisted of silica, alumina, and a little iron.

3. Breislakite lines the small cavities in the lava of Scalla, where it is accompanied by Atacamite and Nepheline. It is also found under similar circumstances in the lava of Olebano, near Pozzuoli.

BREUNERITE. (See *Rhomb-Spar.*)

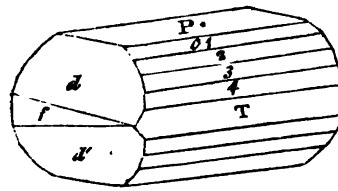
BREWSTERITE. Polyprismatic Kouphone-Spar.

Primary form. Right oblique angled prism. M on T = 93° 40′.

Brewsterite.

Secondary form.

Fig. 77.



P on *d*	-	93°	50′	P on *c*4	-	92°	00′
P on *c*1	-	119	30	*d* on *c*2	-	95	00
P on *c*2	-	114	30	*d* on *d*′	-	175	00
P on *c*3	-	112	00	(172° HAIDINGER.)			

Cleavage, perfect parallel to P, traces parallel to T. Fracture uneven.

Faces slightly streaked parallel to their common intersections.

Lustre vitreous, pearly upon P. Color white, inclining to yellow and grey. Transparent . . . translucent.

Hardness = 5·0 . . . 5·5. Sp. gr. = 2·12 . . . 2·20.

1. Before the blow-pipe, it loses first its water and becomes opake, then it froths and swells up, but is with difficulty fusible. It gives a skeleton of silica with salt of phosphorus.

2. *Analysis.*

By THOMSON.

Silica - - - -	58·800
Alumina - - - -	18 912
Lime - - - -	12·384
Potash - - - -	1·500
Water - - - -	11·700
	103·296.

(The excess of 3¼ p. c. was attributed to soda employed in the analysis.)

3. It is found lining cavities in a granitic rock at Strontian, in Argyllshire in Scotland.

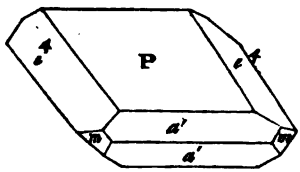
BRIGHT WHITE COBALT. (See *Smaltine*.)

BROCHANTITE. Prismatoidal Vitriol-Salt.

Primary form. Right rhombic prism. M on M′ 117°.

Secondary form.

Fig. 78.



Cleavage; traces parallel to *m*. Surface *m* blackish and dull, the remaining faces smooth and shining.

Color emerald green. Transparent.

Hardness =3·5 . . . 4·0, nearly. Sp. gr. = 3·7 . . . 3·8.

1. *Analysis.*
By Magnus.

Sulphuric acid . . .	17·426
Oxide of copper . . .	66·935
Water . . .	11·917
Oxide of tin . . .	3·145
Oxide of lead . . .	1·048

2. It is found in small, but well defined crystals, on Green Malachite, at Ekatherinburg, Siberia; also in a pulverulent form in France and Hungary.

BRONZITE. Hemi-prismatic Schiller-Spar. Mohs.

Primary form. Oblique rhombic prism. M on M′ 94°. C.

Cleavage; parallel with P very perfect, though in general a little curved; and sometimes having almost imperceptible layers of Calcareous Spar interposed between the laminæ. In the direction of M and M′ less distinct; with traces also in to the diagonals of the cleavage form. Fracture uneven and splintery.

Bronzite.

Lustre metallic pearly upon P; for the rest, low degrees of an imperfectly vitreous lustre. Color dirty shades of leek green and blackish green; also liver-brown, hair-brown and clove-brown, greenish and ash-grey. These colors are heightened by a metalloidal appearance upon P, and often incline to pinchbeck-brown. Streak corresponding to the color. Translucent, sometimes only on the edges.

Rather sectile. Hardness = 4·0 ... 5·0. Sp. gr. = 3·251, a brown variety from Bayreuth.

Compound Varieties. Massive: composition granular, of various sizes of individuals, strongly connected.

1. By the action of fire it assumes a lighter color, and loses its water; but is by itself infusible before the blow-pipe.

2. *Analysis.*

By Kohler.

	From Stempel near Marburg.	Ulten Valley, Tyrol.
Silica	57·193	56·813
Magnesia	32·669	29·677
Lime	1·299	2·195
Protoxide of iron	7·461	8·464
Protoxide of manganese	0·349	0·616
Alumina	0·698	2·068
Water	0 631	0 217

3. Bronzite is found in imbedded crystalline particles, either simple or compound, in serpentine and greenstone rocks. It sometimes presents itself in beds in the serpentine formation, mingled with massive Hornblende.

4. It is found in considerable quantity in and near the Gulsen mountain, in the vicinity of Kraubat in Stiria, where it forms beds in serpentine. It occurs near Hof in Bayreuth, and probably at the Baste in the Hartz, in the Bacher mountain in Lower Stiria, near Marburg, the Ulten Valley in the Tyrol, at Lizard district in Cornwall, and in various other countries.

A variety of this species has been discovered within a few years at Amity, in Orange county, (N.Y.) It occurs in limestone beds, which

are associated with serpentine; and is immediately connected with massive and crystallized Hornblende, Augite, and Plumbago. Its color is a fine reddish brown, attended with a metallic lustre. It has been analyzed by Mr. T. G. CLEMSON, who, under the impression of its being a new species, has bestowed upon it the name of *Seybertite*, after the American analyst, Mr. SEYBERT. But its identity in form, hardness and sp. gr. with Bronzite, does not appear to justify the attempted distinction. Mr. CLEMSON found it to consist of

Alumina	37·60
Magnesia	24·30
Lime	10·70
Silica	17·00
Protoxide of iron	5·00
Water	3·60

BROOKITE. Diatomous Eruthrone-Ore.

Primary form. Right rhombic prism. M on M′ 100°.

Secondary form. Low hexagonal prism.

Cleavage parallel with the shorter diagonal.

Lustre metallic adamantine. Color hair-brown, passing into a deep orange-yellow, and some reddish tints. Streak yellowish white. Translucent . . . opake, the brighter colors are observed by transmitted light.

Brittle. Hardness = 5·5 . . . 6·0.

1. It contains oxide of titanium, with traces of iron and manganese; but has not yet been analyzed. The first varieties were noticed among the minerals accompanying Anatase from Dauphiny; but much finer crystals, some of them half an inch in diameter, have lately been found at Snowdon, in Wales. In both places they are accompanied by Quartz; and in Dauphiny, besides Anatase, it is attended by Crichtonite and Albite.

BROWN IRON ORE. (See *Limonite*.)

BRUCITE. Hemi-prismatic Tourmaline.

Primary form. Oblique rhombic prism. M on M′ 112°? from cleavage.

Brucite.

Secondary form. In very short prisms, apparently having all the edges and solid angles replaced so as to obliterate the lateral and terminal planes. The secondary terminal planes much rounded; the most distinct crystals affording angles over the summit of between 130 and 140° with the common goniometer.

Cleavage parallel with M, M′ indistinct; that parallel with P very indistinct.

Lustre vitreous, to resinous. Color yellow, brown and red. Transparent . . . translucent.

Hardness = 6·5. Sp. gr. = 3·199.

Compound Varieties. Massive: composition granular, of various sizes of individuals.

1. It is fused with difficulty before the blow-pipe. It loses its color almost entirely, becomes opake, and shows traces of fusion on very thin edges. The brown and grey varieties act upon the magnetic needle, where the double magnetism is employed.

2. *Analysis.*

	By D'Ohsson.	By Seybert.
Silica	38·00	32·666
Magnesia	54·00	54·000
Oxide of iron	5·10	0 000
Peroxide of iron	0·00	2·333
Alumina	1·50	0·000
Potash	0·86	0·000
Fluoric acid	0·00	4·086
Water	0·00	1·000

3. Brucite is found disseminated through Calcareous Spar, associated with Hornblende, Spinel and Mica.

4. It occurs at Ersby in the parish of Pargas in Finland, where it was first discovered: but its most abundant localities are in the U. States, in the adjoining counties of Sussex, (New-Jersey,) and Orange, (New York,) where it exists under the circumstances above described, and also accompanied by Spinel, and rarely by Pyroxene and Bronzite. In Sussex county, it is particularly abundant at Newton; and in Orange county, at Amity and Edenville.

BUCHOLZITE. Prismatoidal Axinite.

Primary form. Oblique rhombic prism. M on M′ 99° 30′? Only the primary crystal with curved faces has been observed; and this without regular terminations.

Cleavage parallel with the longer diagonal perfect; parallel with P and M, visible, but indistinct. Fracture conchoidal to uneven.

Lustre vitreous. Color shades of greyish white and hair-brown; sometimes presenting a metalloidal appearance upon M. Bluish opalescence rarely observed upon cleavage faces parallel to M. Streak white. Translucent.

Brittle. Hardness = 7·5 . . . 8·0. Sp. gr. = 3·2.

Compound Varieties. Massive: composition columnar, consisting of delicate, straight or slightly curvilinear individuals, strongly coherent, and sometimes nearly impalpable. Viewed in the longitudinal fracture the lustre is silky; but in the cross fracture, which is even and splintery, it is resinous.

1. The identity of *Sillimanite* with the present species appears probable, not only from the resemblance in the properties of hardness and specific gravity, but in that of crystalline structure; the perfect crystals of the former often becoming compound and fibrous at one end; and the less impalpable masses of Bucholzite, exhibiting crystals which afford the brilliant cleavage surfaces parallel with the longer diagonal of Sillimanite. The disagreement in chemical composition, it is presumed will disappear on searching for zirconia in future analyses of Bucholzite.

Before the blow-pipe, alone, and with borax, infusible.

2. *Analysis.*

	By Bowen, from Chester, Ct.	By Muir, from Chester, Ct.	By Brandes, from Tyrol.	By Hilton & Mitchell, fr. Chester, Pen.
Silica	42·666	38·670	46·00	46·40
Alumina	54·111	35·106	50·00	52·92
Zirconia	0·000	18·510	0·00	0·00
Oxide of iron	1·999	7·216	2·50	a trace.
Water	0 510	0·000	0·00	0·00
Potash	0·000	0·000	1·50	0·00

Bucklandite—Bustamite.

3. The distinctly crystallized variety, or Sillimanite, occurs in veins of Quartz at Chester, (Conn.) in a quarry of gneiss. The compactly fibrous variety was discovered originally in the Tyrol. It exists in the United States, at Chester, (Penn.) near Philadelphia, and at Humphreysville, (Conn.)

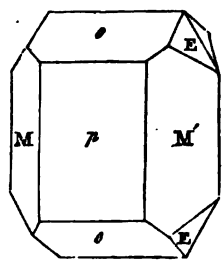
Bucklandite.

Primary form. Oblique rhombic prism? M on M 109° 20′.

Secondary form.

o on M or M′	103°	56′
M on M′	70	40
M on *p*	125	20
o on *p*	114	55
o on *e*	121	30
o on *o*	99	41
o on *e′*	95	40
M on *e′*	160	24

Fig. 79.



Cleavage not observable. Color dark brown, nearly black. Opake. It appears to be harder than Pyroxene.

1. It was discovered in small crystals on a specimen from Neskiel mine, near Arendal in Norway, where it occurs with black Hornblende, Scapolite and Calcareous Spar. It resembles Pyroxene.

2. It is not sufficiently described to settle the question of its specific character.

BUSTAMITE. Staphyline Parachrose-Baryte.

Massive: in reniform and botryoidal groupes.

Color, light grey, passing into a greenish or reddish color. Nearly opake.

Hardness = 6·0 . . . 6·5. Sp. gr. = 3·1 . . . 3·3.

1. *Analysis.*

By Dumas.

Silica	48·90
Protoxide of manganese . .	36·06
Lime	14·57
Protoxide of iron	0·81

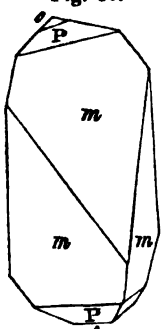
2. It occurs at Real de Minas in Mexico.

CALAMINE. Rhombohedral Zinc-Baryte. MOHS.

Primary form. Rhomboid. P on P′ =107° 40′.

Secondary forms.

Fig. 80.

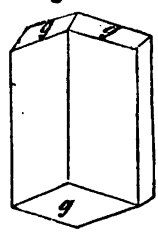


Rezbanya.

Fig. 81.

Siberia.

Fig. 82.



g on *g* 137° 8′

m on *m* 113° 31′.

Cleavage, parallel with the primary form perfect, often curved. Fracture uneven, imperfectly conchoidal. Surface of the primary faces generally curved, and often rough.

Lustre vitreous, inclining to pearly. Color white, though seldom pure: generally grey, green, or brown. Streak white. Semi-transparent... translucent.

Brittle. Hardness =5·0. Sp. gr.=4·442.

Compound Varieties. Reniform, botryoidal, stalactitic, and other imitative shapes; surface generally rough, composition columnar. Massive: composition granular, sometimes impalpable; strongly coherent. By decomposition, it becomes friable and earthy. Crystalline coats and pseudomorphoses formed after crystals of Calcareous Spar,

1. Before the blow-pipe it loses its transparency, but is infusible; the carbonic acid is driven off, and the residue acts like pure oxide of zinc. It is soluble in nitric acid with effervescence. It is negatively electrified by friction.

2. *Analysis.*

By SMITHSON.

Oxide of zinc	65·20
Carbonic acid	34·80

3. Calamine is found, often associated with Electric Calamine, in veins and beds belonging to various classes of rocks, but chiefly in those which are calcareous; and they are usually accompanied by ores of lead, copper, iron and zinc.

4. It occurs in the Bannat of Temeswar in Hungary, at Raibel and Bleiberg in Carinthia, at Tarnowitz in Silesia, at Medziana in Poland, at Aix la Chapelle; also in France, and in Leicestershire, Derbyshire, Flintshire, Somersetshire, in England, and at Wanlockhead and Lead hills in Scotland. Calamine exists in the United States in great abundance, in Jefferson county, Missouri, at a lead mine called Valle's Diggings. Other localities of this species less remarkable, are the Perkiomen lead mine, Pennsylvania, and the iron mine at Franklin, New Jersey: at the latter place, however, it only occurs in a pulverulent form, from the decomposition of Red Zinc-Ore.

CALCAREOUS HEAVY SPAR.

This mineral, imperfectly distinguished by BREITHAUPT from Heavy Spar, is described as follows: Crystals, right rhombic prisms, surmounted by pyramids; the lateral planes inclining under angles of 101° 53′. Cleavable parallel with the base with great distinctness, and nearly as much so with the lateral faces of the rhombic prism. Lustre pearly to vitreous. Sp. gr. = 4·02 ... 4·29. Locality is not mentioned.

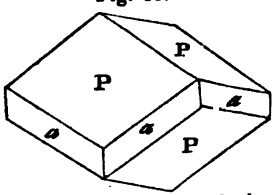
CALCAREOUS SPAR. Rhombohedral Lime Haloide. MOHS.

Primary form. Rhomboïd. P on P=105° 5′.

Calcareous Spar.

Secondary forms.

Fig. 83.



Derbyshire and Cumberland.

Fig. 84.

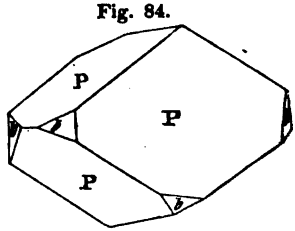


Fig. 85.

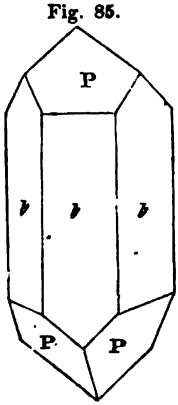
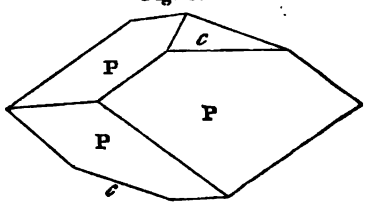
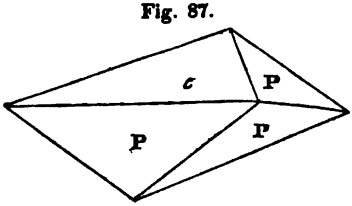


Fig. 86.



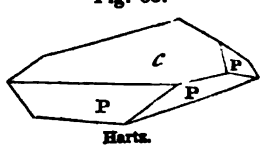
Cadiz, Spain.

Fig. 87.



Hartz.

Fig. 88.



Hartz.

Calcareous Spar.

Fig. 89.

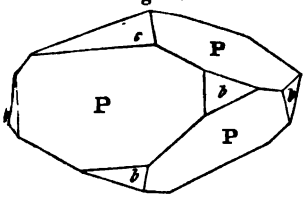


Fig. 90.

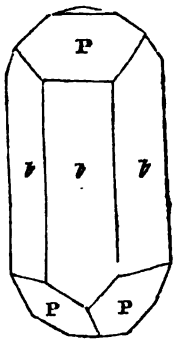
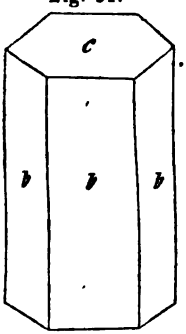
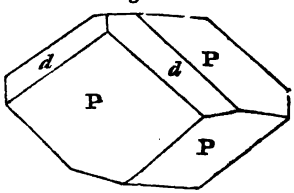


Fig. 91.



Harts, Cumberland and Derbyshire.

Fig. 92.



Dauphine and Derbyshire.

Fig. 93.

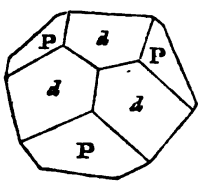
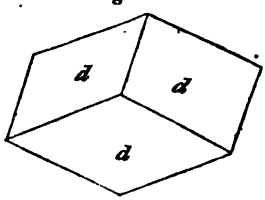


Fig. 94.



Calcareous Spar.

Fig. 95.

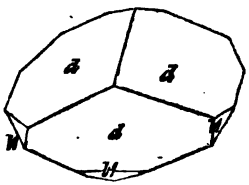
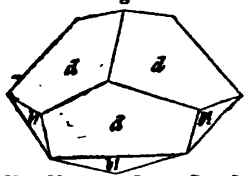
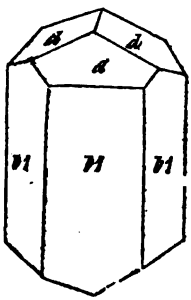


Fig. 96.



Near Montreal, (Lower Canada.)

Fig. 97.



Leyden, (N.Y.)

Fig. 98.

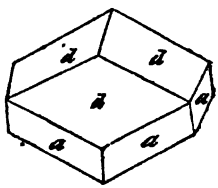
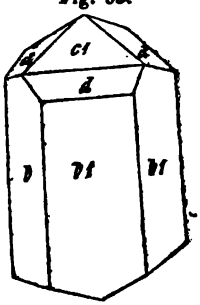
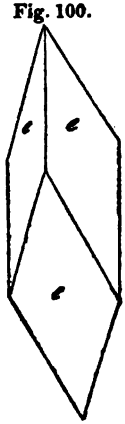


Fig. 99.



Hartz and Cumberland.

Fig. 100.



Calcareous Spar.

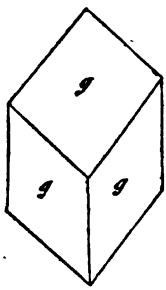
Fig. 101.

Westmoreland, (England.)

Fig. 102.

Hartz and England.

Fig. 103.



Southbury, (Conn.)

Fig. 104.

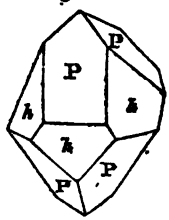


Fig. 105.

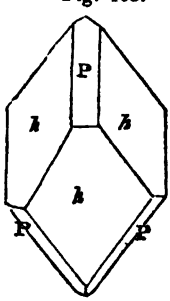


Fig. 106.

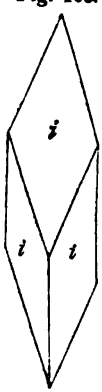
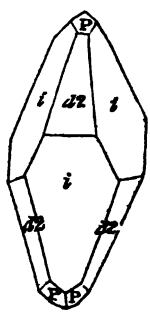


Fig. 107.



Calcareous Spar.

Fig. 108.

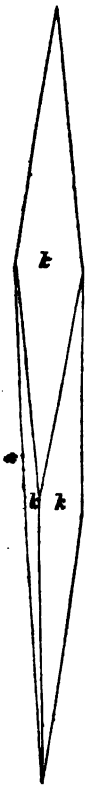


Fig. 109.

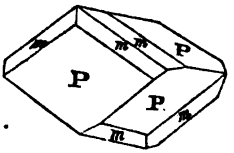
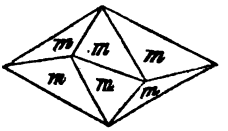


Fig. 110.



Derbyshire and Cumberland.

Fig. 111.

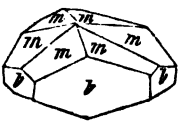


Fig. 112.

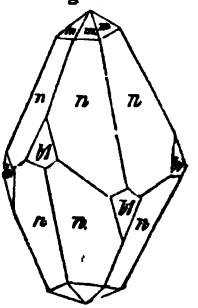


Fig. 113.

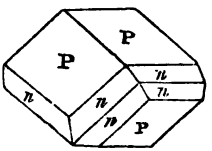


Fig. 114.

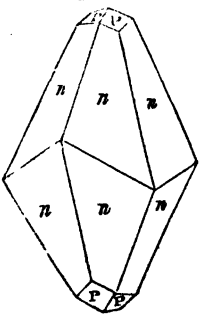


Fig. 115.

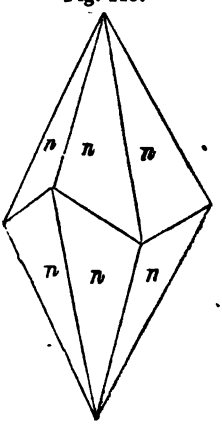


Fig. 83. The primary with its lateral edges replaced by tangent planes, *a*: P on *a* = 135°. The crystals of this modification differ in the length of the new planes *a*. Fig. 84. The primary with its lateral angles replaced by tangent planes, *b*. Fig. 85, has the planes elongated: this is the most common modification of the species. The planes P are often irregularly extended; and sometimes one or two of them are wholly wanting from each extremity of the prism. P on *b* = 135°. Fig. 86. The primary, having its summit replaced by a tangent plane. Fig. 87 and 88, the same, with the new plane more extended: these form the *basées* of Hauy. P on *c* = 135°. The faces *c* are liable to a pearly lustre. Fig. 89 unites the modifications of Figs. 84 and 86. Fig. 90, the same, with the faces *b* more extended so as to produce an elongated prism. Fig. 91, the regular hexagonal prism, produced from Fig. 90 by the extension of *c*: the *prismatique* of Hauy. Occasionally, the prism is reduced in length to a mere table. Hartz. Sometimes this modification is affected by the undue enlargement of certain of the lateral faces, so as to convert it into a trihedral, tetrahedral or pentagonal prism. Fig. 92. Primary, with its upper edges replaced by tangent planes. P on *d* = 149° 2′. Fig. 93, the same, more deeply replaced. Fig. 94, *d* on *d* = 134° 26′. This is called the equilateral rhomboid: it is the *equiaxe* of Hauy. It is a very abundant form of Calcareous Spar. Fig. 95, the same, having the lateral angles replaced by tangent planes. *d* on *b*1 = 116° 34′. Figs. 96 and 97, the same, in which *b*1 is variously produced. Fig. 98, the equilateral rhomboid, with its lateral edges replaced by tangent planes. These prisms are sometimes elongated. Fig. 99, the same as Fig. 97,

but having the summit replaced by a tangent plane. *d* on *c*1=153° 26′. Four other rhomboids, of the following dimensions: viz. 115° 42′, 129° 54′, 151° 48′, and 156° 24′, derivable from the primary by tangent replacements of its upper edges, the new planes inclining differently to the vertical axis, undergo many of the modifications above described with respect to the primary and the equilateral rhomboids; but their forms are not common.

In addition to the foregoing rhomboids, Calcareous Spar presents a great variety of acute rhomboids, of which Fig. 100 is one of the most common. It is the *contrastant* of Hauy. Its localities are numerous. This rhomboid goes through the modifications above described; and in addition to them, it occurs having the summits replaced by three new planes: in one instance, the new planes resting upon the rhomboidal planes; and which incline under angles of 105° 5′, being portions of the primary form; and in the other, resting upon the edges and inclining towards the axis. *e* on *e*=65° 41′; Fig. 101, a rhomboid still more acute, *f* on *f*=60° 34′. Fig. 102, the same, with the upper edges replaced by tangent planes; the *contractée* of Hauy. *f* on *d*1=112° 9′ 59″. *d*1 on *d*1=134° 25′ 38″. Fig. 103 is a rhomboid slightly acute. *g* on *g*=87° 48. It approaches the cube in form; and is called by Hauy, the *cuboide*. It is not common. It suffers the same modifications as the last described rhomboid. Figs. 104 and 105 explain the passage of the primary into an acute rhomboid, called the inverted rhomboid, in consequence of its being a complete inversion of the primary rhomboid. P on *h*= 129° 13′ 53″. *h* on *h*=78° 27′ 47″. This form is found undergoing all the modifications above described, and many

others; amounting in all to more than forty. Fig. 106, a still more acute rhomboid, the cleavage of whose crystals takes place at the summits, directly upon the edges. It is the *mixté* of HAUY. *i* on *i* = 63° 44′ 55″. It is common. P on *i* = 119° 2′ 11″. Fig. 107 is the same, having the primary planes at the summit, and having the upper edges replaced by the planes *d*2. P on *d*2 = 149° 2′ 11″, *i* on *d*2 = 149° 2′ 11″, *i* on *d*′2 154° 39′ 14″. Fig. 108 is the most acute of all the rhomboids of Calcareous Spar. It is called the *dilatée* of HAUY. It is not very rare, either perfect, or suffering the modifications above described. *k* on *k* = 60° 24′. Fig. 109 represents the primary rhomboid having its upper edges replaced by two planes,—the commencement of the dodecahedron with scalene triangular planes, as represented in Fig. 110. *m* on *m* over the summit = 121° 26′. Fig. 111 has the lateral solid angles replaced by tangent planes; and Fig. 112 has in addition, the upper edges of *b*1 replaced by the planes *n*, which forms the *soustractive* of HAUY. Numerous other faces, in addition to these, occur in some of the varieties. *n* on *b*1 = 152° 6′ 52″, *n* on *n* = 161° 48′ 18″. Fig. 113 is the primary rhomboid, having its lateral edges replaced by two planes *n*. It is very common in this condition; and with the new planes more extended, as in Fig. 114, it forms the *binaire* of HAUY; and when they are still more so, as in 115, it forms the *metatastique* of the same author. Fig. 113 undergoes more than one hundred modifications. P on *n* = 151° 2′ 40″. *n* on *n* over the summit = 48° 22′. *n* on *n* over the base = 104° 28′ 40″. *n* on *n* over a pyramidal edge = 144° 20′ 26″. *b*1 on *n* = 152° 6′ 52″.

Calcareous Spar.

Cleavage parallel to the primary rhomboid, easily obtained, even and highly perfect. Fracture, perfectly conchoidal, but difficult to be obtained.

Surface generally even: rarely, curved faces appear in certain rhomboids and pyramids.

Lustre vitreous. The lustre of *c* is sometimes pearly. Color white, prevalent. Also different shades of grey, red, green, yellow; all of them pale. Dark brown and black colors owing to foreign admixtures. Streak greyish white. Transparent... translucent; double refraction very considerable, and easily observed.

Brittle. Hardness =3·0. Sp. gr. =2·721, a transparent crystal.

Compound Varieties. Twin-crystals.

Fig. 116.

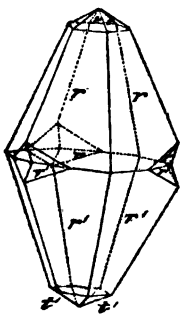


Fig. 117.

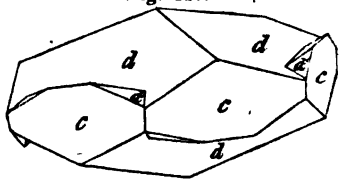


Fig. 118.

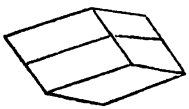
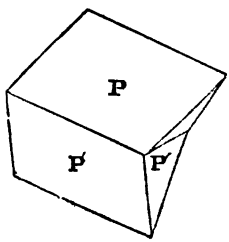


Fig. 119.



Calcareous Spar.

Fig. 120.

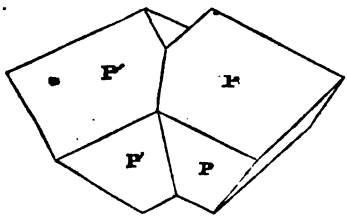
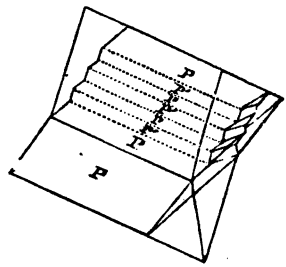


Fig. 121.



In Fig. 116 and 117 the face of composition is perpendicular to the axis of the aggregated crystals; and the angle of Revolution $=60°$. In Fig. 119 the face of composition is represented by the dotted lines in Fig. 118. In Fig. 120 it coincides with a plane passing through its vertical axis: in both, the angle of revolution $= 180°$. The regular composition in faces parallel to the plane indicated in Fig. 118, takes place also in massive varieties; and then more or less thick laminæ of the two individuals alternate with each other, as in Fig. 121. The frequent occurrence of those well known striæ (here delineated) upon the faces of cleavage, parallel to the horizontal diagonal of the rhombs, depends upon this mode of regular composition.

Implanted globules; stalactitic, botryoidal, fructicose shapes: surface uneven, drusy, rough or smooth, composition columnar, more or less distinct, straight diverging, and of various sizes. Stalactitic and botryoidal varieties are often composed a second time of curved lamellar particles, conformably to the surface of the imitative shapes, the faces of composition being uneven and rough, or irregularly streaked in a longitudinal direction.

Calcareous Spar.

Massive: 1. Composition columnar, the individuals being straight, parallel, or diverging, very often of remarkable delicacy. In a second composition, globular masses are produced, consisting of curved lamellar particles, the faces of composition between the latter often being smooth. These globules are again joined in a third composition, producing granular masses, between which the faces of composition are uneven and rough. 2. Composition granular, the individuals being of various sizes, and even impalpable; faces of composition irregularly streaked, uneven and rough. The individuals cohere more or less firmly. If the composition be impalpable, fracture becomes splintery, uneven, flat, conchoidal, or even; on a large scale it is sometimes slaty. The fracture is earthy in those varieties in which the individuals cohere but slightly. 3. Composition lamellar; the indviduals more or less thin, and often bent; face of composition sometimes rough, and possessing a pearly lustre. Globules formed in cavities; plates, of various kinds of composition.

1. The species of Calcareous Spar, as at present regarded by the majority of mineralogists, probably embraces several distinct species, separated from one another by constant differences of form, hardness and specific gravity. An attempt has been made within a few years by Breithaupt, to determine, by some of the nicest mineralogical researches of modern times, a number of such species. But as the differences upon which he founds his conclusions are so slight, in comparison with specific differences in general in the mineraal kingdom, it seems most judicious for the present to introduce his results in the form of an appendix to this species, where they will be found given in sufficient detail to enable the mineralogical student to appreciate their value.

The division of Calcareous Spar into several sub-species and varieties, in the older treatises on the science, depends chiefly upon the mode of composition, and upon admixtures and impurities, with which the individuals have been affected in their formation. Of these *Limestone* rep-

resents the greater part of the pure varieties of the species. The simple varieties, and such compound ones in which the indviduals are of considerable size, and easily cleavable, have been called *Calcareous Spar;* compound varieties of granular, still discernible individuals, are *granular Limestone*, both comprehended under the head of *foliated Limestone*. If the granular composition disappear, *compact Limestone* is formed; under which denomination also, Oolite or Roestone was included; the roundish grains, however, of the latter, consist of columnar individuals, disposed like the radii of a sphere, and frequently showing distinct traces of cleavage. *Common fibrous Limestone* is produced by columnar composition in massive varieties; the *fibrous Calcsinter* by the same, but appearing in various imitative shapes. *Pea-stone* or *Pisolite* consists of diverging columnar individuals, collected into curved lamellar ones, forming globular masses, which are again agglutinated by a calcareous cement. Each of the globules generally contains a grain of sand, which is of Quartz or Feldspar. Compact limestone passes into *Chalk*, if the individuals are more loosely connected with each other, so that the whole assumes an earthy appearance; and *Rock milk* or *Agaric mineral* is formed, if the mass contains so many interstices, that it seems to possess but a small degree of specific gravity. *Calcareous tufa*, a recent deposit formed on the surface of the earth, is often cleavable, and thus possesses all the properties of the variety called Calcareous Spar. *Slate-spar* or *Argentine*, is produced by a lamellar composition in massive varieties, in the direction of the face of composition Fig. 119 of twin-crystals, contained in thin parallel layers. *Swinestone*, *Anthracolite*, *Marl* and *Bituminous Limestone*, are impure and mixed varieties, partly of calcareous spar, partly of compact limestone.

The pure varieties of Calcareous Spar are entirely soluble, with effervescence in nitric or muriatic acid. In the common fire they are infusible, but part with carbonic acid, and become converted into quick-lime.

2. *Analysis.*

According to the analyses of several of the first chemists, Calcareous Spar consists of

Lime	- -	56·0 ... 57·0
Carbonic acid	- -	43 0 ... 44·0

The varieties very often contain a small portion of oxide of iron, silica, magnesia, alumina, carbon or bitumen.

3. Calcareous Spar rarely enters into the composition of rocks. In most cases, the more considerable masses of it form particular beds in other rocks, or constitute rocks themselves: the latter consist chiefly of

compact limestone; the former of granular limestone. The simple varieties occur in drusy cavities, more frequently in veins than in beds, accompanied with the varieties of different species. Columnar compositions have been observed to form veins by themselves, and a great number of varieties are met with in the cavities of several rocks. Slate spar is generally a product of beds of granular limestone; calcareous tufa and rock-milk, being of a sintery formation, occur upon the surface, and in fissures of limestone rocks, and rock-milk in particular is generally a very pure carbonate of lime. Stalactitic and pisiform varieties are produced by calcareous springs and other waters. The original repository of Anthracolite is not known, it having as yet been found only in large boulders. The impure varieties occur in particular strata, between those of compound varieties of other species. This species is very common in petrifactions, imbedded in compact varieties of the same species.

4. Calcareous Spar is one of the most widely diffused species. Several of its varieties have a considerable share in the constitution of mountains in many countries. This is particularly true in Switzerland, Italy, Carniola, Carinthia, Salzburg, Stiria, and in several parts of the United States. Beds of granular limestone in gneiss and mica slate, abound in all the New England States; also in New York, New Jersey and Pennsylvania; also, of the compact limestone, in Upper and Lower Canada, upon Lake Champlain, and throughout the vast district contained between the Alleghany mountains, the lakes and the Mississippi. Of crystallized varieties, the most remarkable occur in Derbyshire and Cumberland, in the mining districts of Saxony and Bohemia, in the Hartz, in Carinthia, Stiria, Hungary, and France; and in North America, at Bytown, (Lower Canada,) Kingston, (Upper Canada,) Lockport and Leyden, (New York,) and the Silver mines of Mexico. Iceland is the locality of its finest and most transparent varieties, from whence come the best pieces of the doubly refracting spar. The *crystallized sandstone* of Fontainbleau in France, (*Chaux carbonatée quartzifère of* Hauy,) is a variety of calcareous spar, mechanically mixed with sand. When crystallized, it assumes the form of the inverted rhomboid. Argentine occurs in Saxony, Norway and Cornwall, and in the United States at Williamsburg and Southampton, (Mass.,) in the lead veins, as well as in the iron mine of Franconia, (N. H.) Picrolite is found in Carniola, and at Carlsbad in Bohemia. Anthracolite is found in Salzburg. Calcareous Tufa abounds in the States of New York and Ohio, where its formation at the surface of the ground, or in cavities of compact limestone, is constantly progressing. Stalactitic varieties are particularly abundant

in the caves of Virginia and Kentucky. Most of the varieties are so common as to render the mention of their localities unnecessary.

5. Several varieties of Calcareous Spar are usually employed for various purposes, partly depending upon their mechanical, partly upon their chemical composition. Those used in sculpture, and in ornamental architecture, are called *marble;* the more common or coarse varieties are used for the common purpose of building. A peculiar variety of very fine grained, compact limestone, is used for plates in lithography. The best sort is found near Pappenheim and Sohlenhofen in Bavaria. Quick lime is obtained from the calcination of this species. Carbonic acid for chemical purposes, as well as for the impregnation of artificial mineral waters, is obtained from chalk and from marble powder. Chalk is also used for writing and for whitewashing. Calcareous Spar is likewise a valuable addition in several processes of melting ores, and in producing certain kinds of glass.

Appendix to Calcareous Spar.

i. *Archigonal Carbon-Spar.* Breithaupt.

P on P = 105° 0′.
Cleavage parallel to the primary rhomboid, perfect.
Hardness (scale of Breithaupt) = 4·0 . . . 4·25.
Sp.gr. = 2.7348, a cleavable fragment from Neue Hoffnung Gottes at Bräunsdorf, west of Freiberg.
2·7362, a similar variety, but less cleavable.
2·7426, cleavage forms, from Himmelsfürst in Freiberg.
2·7485, cleavage forms, very clear and beautiful, from the Tunge hohé Birke in Freiberg.
2·7500, dull crystalline fragments, from Himmelsfürst.

Other localities of the Archigonal Carbon-Spar at Freiberg, are the Beschert Glück and Himmelfahrt mines. Besides, it occurs at Johann Georgenstadt, at Schneeberg in the Erzgebirge, and at Przibram in Bohemia; and on the whole is a frequently occurring species.

ii. *Kouphone Carbon-Spar.* Breithaupt.

P on P = 105° 2′ 30″.
Cleavage parallel to the primary rhomboid, perfect.
Hardness (scale of Breithaupt) = 3·75.
Sp. gr. = 2·6788, cleavage forms, from Kornial-Hole at Trieste, in mountain limestone.

Color, brick-red, like the Heulandite from Fassa, Tyrol.
Its only locality is Trieste.

iii. *Eugnostic Carbon-Spar.* BREITHAUPT.

P on P = 105° 5′.
Cleavage parallel to the primary rhomboid, very distinct.
Hardness (scale of BREITHAUPT) = 3·75 . . . 4·00.
Sp. gr. = 2·7170, a clear cleavage crystal from Iceland.
2·7171, a clear cleavage crystal, but of a flesh-red color, from Iberg in the Hartz.
2·7177, a clear cleavage crystal, from the same place.
2·7179, a cleavage crystal, from Rotluf in Chemnitz, in the Erzgebirge.
2·7190, a clear crystal, from Ahren in Tyrol.
2·7190, three clear cleavage crystals, from Boiza in Siebenbürgen.
2·7203, cleavage crystal, from a beautiful white Calcareous Spar from Moderstolln, *Schemnitz.*

1. A variety analyzed by STROMEYER, from Iceland, contained

Carbonic acid - - - -	43·70
Lime - - - -	56·15
Oxide of manganese and iron -	0·15

iv. *Polymorphous Carbon-Spar.* BREITHAUPT.

P on P = 105° 8′.
Cleavage parallel to the primary rhomboid very distinct.
Hardness = (scale of BREITHAUPT) = 0·4.
Sp.gr. = 2·7088, locality not known.
2·7089, a cleavage crystal. Maxen at Dresden.
2·7100, a cleavage crystal. Braunsdorf in Tharand.
2·7110, a cleavage crystal, of a pale wine-yellow color, locality unknown.
2·7111, a cleavage crystal, of a pale wine-yellow color, from Derbyshire.
2·7122, a cleavage crystal, milk-white to blue, from Cziklowa in the Bannat.
2·7125, a cleavage crystal, white and transparent, from Stanowski Gorni in Karczowka.

The following varieties probably belong to this species.

Calcareous Spar.

Sp.gr. = 2·7081, milk-white, translucent Calcareous Spar, from Scheibenberg in the Erzgebirge.

2·7084, milk-white, from Krodendorf in the Erzgebirge. Lustre resinous, or oily.

This is the most abundant species of the family; and occurs in formations of nearly every age. A variety from Andreasberg, analyzed by STROMEYER, afforded

Carbonic acid - - -	43·5635
Lime - - -	55 9802
Oxide of manganese and iron -	0·3563
Water - - -	0·1000

v. *Meroxene Carbon-Spar.* BREITHAUPT.

P on P = 105° 11′.

Cleavage perfect parallel with the primary rhomboid.

Hardness (scale of BREITHAUPT) = 4·0.

Sp.gr. = 2 6895, a fragment of a crystal, from Tharaud in Dresden.

2·6903, cleaved from massive variety, associated with Natrolite, from Mariaberg in Aussig, Bohemia.

Most of the zeolitic druses from Iceland are supposed to contain this species.

vi. *Haplotypous Carbon-Spar.* BREITHAUPT.

P on P = 105° 13′ 40″.

Cleavage, less perfect than in the foregoing species.

Hardness (scale of BREITHAUPT) = 4·25.

Sp.gr. = 2·7280, } fragments of crystals of a wine-yellow color,
2·7294, } from the galleries of Verlorne Hoffnung and Neue Hoffnung Gottes at Braunsdorf, west from Freiberg.

The following Calcareous Spars have a similar specific gravity and a similar hardness:

2·7259, greyish white, in large compact masses from Alten August in Freiberg.

2·7260, translucent, yellowish white, cleavage masses intermingled with Vitreous Copper, from Sangerhausen, Thuringia.

2·7272, smoke-grey, large crystals, from Neu Glück in Schneeberg in the Erzgebirge.

2·7284, white cleavage crystals, at Zaukerode near Dresden.
2·7300, a crystal from Northumberland.

The most of these varieties are too imperfectly cleavable to admit of accurate measurement.

vii. *Melinous Carbon-Spar.* BREITHAUPT.

P on P = 105° 17′.
Cleavage perfectly obtained parallel with the primary rhomboid.
Hardness (scale of BREITHAUPT) = 4 . . . 4·25.
Sp.gr. = 2·6958, honey yellow, cleavage crystals from Neudorf at Borna.
2·6968, from Mont Martre near Paris.

It is found in green-sand and in plänerkalkstein in Saxony. It also occurs at Cotta, at Naundorf in Borna, and again on the lower portions of Zehista in the region of Pirna. Under similar circumstances at Dux in Bohemia.

viii. *Diastatic Carbon-Spar.* BREITHAUPT.

P on P = 105° 43′.
Cleavage parallel with primary rhomboid perfect.
Hardness (scale of BREITHAUPT) = 4 . . . 4·25.
Sp.gr. = 2·7698, massive variety from Seegen Gottes, Freiberg.
2·7758, cleavage crystals from Habacht, Freiberg.
2·7870 common fibrous limestone, from Adam Heber in Schneeberg.

ix. *Plumbo-Calcite.* TURNER. Carbonate of Lime and Lead.

P on P = 104° 53′ 30″.
Hardness. It is scratched by Iceland Spar.
Surface of crystals slightly rounded.
Lustre pearly. Sp. gr. = 2·82.
Massive and opake.

Heated in a platina crucible, or in a glass tube, it decrepitates, and after some time assumes a brownish, or pale reddish tint. It consists of

Carbonate of lime	92·2
Lead	7·8

x. *Prunnerite.* ESMARK.

The violet blue variety of Calcareous Spar, occurring with Apophyllite in the Island of Hestoe, one of the Faroes, and hitherto arranged as a variety of cuboidal Calcareous Spar, has been established into a distinct

species by ESMARK; the grounds of this distinction however, are not as yet made known.

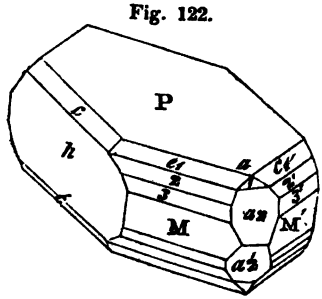
CALCEDONY. (See *Quartz*.)

CALEDONITE. Cupreous Lead-Baryte.

Primary form. Right rhombic prism. M on M′=95°.

Secondary form.

Fig. 122.



M on M′	95°	00′	BROOKE.	M on e1	144°	00′
P on M or M′	90	00		M on h	132	30
P on a2	108	00		a2 on a2′	143	42
P on c	126	00		a2 on e2	140	40
P on e1 or e1′	126	00		c on h	144	30
P on e2 or e2′	115	30		e1 on e1′	108	00
P on h	90	00		e2 on e2′	128	35

Cleavage, parallel to M and T indistinct, but parallel to *h* more obvious. Fracture uneven. Surface streaked.

Lustre resinous.

Color deep verdigris-green; inclining to mountain-green, if the crystals are very delicate. Streak greenish-white. Translucent.

Rather brittle. Hardness =2·5 . . . 3·0. Sp. gr.=6·4.

1. *Analysis.*

By BROOKE.

Sulphate of lead	55·8
Carbonate of lead	32·8
Carbonate of copper	11·4

2. It is found along with other ores of lead at the Lead Hills of Scotland.

CANNEL COAL. (See *Bituminous Coal.*)

CAOUTCHOUC MINERAL. (See *Bitumen.*)

CAPILLARY PYRITES. Capillary Chlorone-Pyrites.

Delicate, capillary crystals.

Lustre metallic. Color brass-yellow, inclining to bronze-yellow and steel-grey.

1. Before the blow-pipe, it melts into a brittle metallic globule; it colors glass of borax, violet-blue. In nitric acid, it is dissolved without leaving a residue, forming a pale green solution.

2. *Analysis.*

By ARFWEDSON.

Nickel	64·35
Sulphur	34·26

3. It occurs at Johanngeorgenstadt in Saxony, Joachimsthal in Bohemia, St. Austle in Cornwall, and in the Westerwald, accompanied by several species of Pyrites, and by Calcareous Spar.

CARBOCERINE.

The composition of this mineral, as carbonate of cerium, given by BERZELIUS, is all the information we possess concerning it.

CARBONATE OF BARYTES. (See *Witherite.*)

CARBONATE OF BISMUTH.

Earthy.

Color grey and brown.

Sp. gr. = 4·3.

1. *Analysis.*

By MCGREGOR.

Carbonic acid	51·50
Oxide of bismuth	28·80
Oxide of iron	2·10
Alumina	7·50
Silica	6·70
Water	3·60

2. It was found at St. Agnes in Cornwall.

3. From the inconsistency of the chemical results obtained above, with the known laws of chemical combination, it seems probable that some mistake has been committed in the analysis.

CARBONATE OF COPPER. (See *Blue Malachite* and *Green Malachite.*)

CARBONATE OF IRON. (See *Spathic Iron.*)

CARBONATE OF LEAD. (See *White Lead-ore.*)

CARBONATE OF LIME. (See *Calcareous Spar.*)

CARBONATE OF LIME AND MAGNESIA. (See *Dolomite.*)

CARBONATE OF MAGNESIA. (See *Magnesite.*)

CARBONATE OF MAGNESIA AND IRON. (See *Rhomb Spar.*)

CARBONATE OF MANGANESE. (See *Diallogite.*)

CARBONATE OF SODA. (See *Natron* and *Trona.*)

CARBONATE OF SODA AND LIME. (See *Gay-Lussite.*)

CARBONATE OF STRONTIAN. (See *Strontianite.*)

CARBONATE OF ZINC. (See *Calamine.*)

CARBONIC-ACID. Aeriform Carbonic-Acid. MOHS.

Gaseous. Transparent.

Sp. gr. =1·51961. BIOT and ARAGO. Taste slightly acidulous; pungent.

1. It extinguishes burning bodies of all kinds, and is incapable of supporting the respiration of animals. It reddens the vegetable blues; but the original color is restored by heating, or exposure to the air. Lime and barytic-water, become turbid when brought into contact with it; and it is absorbed by recently boiled water at the common pressure and temperature, in a quantity equal to the volume of the water. Under a pressure of 36 atmospheres, carbonic acid becomes converted into a liquid.

2. *Analysis.*

By BERZELIUS.

Carbon	27·40
Oxygen	72·60

3. It is found in the largest quantity and highest degree of purity upon the surface of *carbonated* springs, and in caves; in which cases it issues directly from the earth. Of the most remarkable of these sources of the present species in the United States, are the springs of Saratoga and Ballstown near Albany. An ingenious hypothesis to account for the origin of the carbonic acid in these localities, and many others of less importance in the vicinity, has been proposed by Prof. EATON. The rock through which the waters rise is an argillite, containing large quantities of iron-pyrites and carbonate of lime. The iron-pyrites, he conceives, is decomposed by water, the sulphuric acid thus formed being in contact with the carbonate of lime, gypsum is produced, and carbonic acid disengaged; which being situated at great depths in the earth, and consequently under great pressure, combines with water in large proportions; and when the waters thus charged issue from the earth, the pressure being removed, they part with their superabundant carbonic acid. The well known mineral springs of Tunbridge and Carlsbad are remarkable for the evolution of this acid gas. It issues from a small cave in the side of a mountain near Naples, the floor of which, to the depth of a foot or more, is covered with a stratum of this noxious fluid, into which, if a dog be introduced, he is immediately suffocated. It has hence been called the *grotto del cane*. Another cave of a similar character exists in the Büdös hegy, a porphyry mountain in Transylvania. Carbonic acid is also emitted from certain marshes, and from the solfataras. In addition to the foregoing sources of this species, it is formed abundantly by the combustion of all substances that contain carbon, the respiration of animals, and the spontaneous changes to which dead animal and vegetable matter is subject. Accordingly, it is always present in the atmosphere, even at the highest elevations. All kinds of spring and well-water contain it dissolved in them, and to the presence of which they are partly indebted for their agreeable flavor. Where carbonic acid is evolved in low situations, it is liable from its gravity to accumulate; a circumstance which often happens in deep mines and wells, in which it forms an atmosphere known in English by the name of *choke-damp*, in German by the name of *Schwaden* or *Swath*.

4. Carbonic acid is applied to a variety of purposes in medicine and the arts.

CARBURETTED HYDROGEN. Empyreumatic Hydrogen Gas. Mohs.

Amorphous. Transparent. Expansible.
Sp. gr.=0·5707. Odor empyreumatic.

1. It burns with a bright flame, sometimes tinged with blue.

2. *Analysis.*

Carbon	74·87
Hydrogen	25·13

3. It is developed from marshes and stagnant pools, and is also found in volcanic countries. But its greatest source is certain coal mines and salt springs.

4. It is particularly abundant at Newcastle and Liège, where it is denominated fire-damp. Numerous localities of it might be cited in Ohio and New York; the more remarkable of which, however, is Fredonia, 40 miles from Buffalo, where it was first observed to bubble up from a small stream; but on boring a hole 1½ inch in diameter through a soft fetid limestone rock, of no great thickness, the gas left the stream, and was discharged by this orifice. The brilliancy of the flame led to its being adopted as a means of illuminating the village. A gazometer collects 80 cubic feet in 14 hours.

Carburet of Iron. (See *Plumbago.*)
Carnelian. (See *Quartz.*)
Cavolinite. (See *Nephiline.*)
Ceylanite. (See *Spinel.*)

CELESTINE. Prismatoidal Hal-Baryte. Mohs.

Primary form. Right rhombic prism. M on M′ = 104°.

Celestine.

Secondary forms.

Fig. 123.

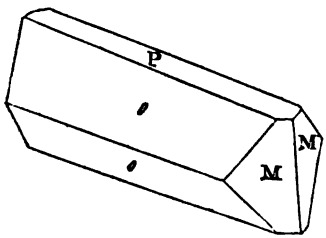


Fig. 124.

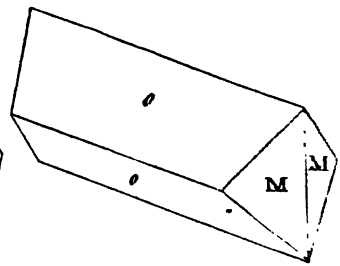


Fig. 125.

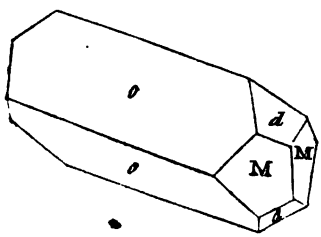


Fig. 126.

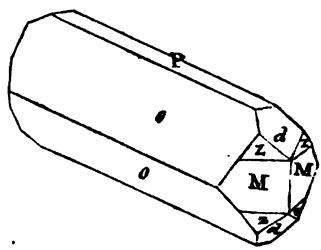


Fig. 123, the primary with its acute solid angles replaced by single planes. P on $o = 128° 31'$. Fig. 124, the same, in which the terminal plane of the primary is extinguished. o on $o = 102° 58'$; o on o over the summit $= 77° 2'$. Fig. 125, like Fig. 124, but having the obtuse solid angles replaced by planes d; d on $d = 78° 28'$. Fig. 126, P on $d = 140° 46'$; M on $z = 154° 6'$.

Cleavage parallel to the sides of the primary form, highly perfect; that of the bases less distinct. Fracture imperfectly conchoidal, uneven.

Celestine.

Lustre vitreous, inclining to resinous; sometimes also, a little to pearly on the perfect faces of cleavage. Color white prevalent, passing into bluish-grey, sky-blue and smalt-blue. Also reddish-white and flesh-red. Transparent... translucent.

Brittle. Hardness = 3·0...3·5. Sp. gr. = 3·858, a white translucent, cleavable variety, from the Tyrol.

Compound Varieties. Imperfect globular shapes, surface drusy, composition columnar. Plates more or less thin: surface rough, composition columnar, thin and parallel. Massive: composition either lamellar and aggregated into larger granular masses; or columnar, generally straight and divergent; or granular, the individuals being of various sizes. Faces of composition smooth, rough or irregularly streaked.

1. The varieties of the present species have been variously divided in the mineralogical systems into subspecies and kinds, notwithstanding they are connected among themselves by immediate transitions. Tabular crystals, and lamellar compound masses, were called *foliated Celestine;* others of columnar crystallizations and compositions, *prismatic Celestine.* Among the massive varieties were distinguished *radiated Celestine*, consisting of thin columnar compositions, radiating from a centre; *fibrous Celestine*, comprehending the thin plates, formed by delicate columnar particles of composition; and compact Celestine, which is a mechanical mixture of Celestine and Calcareous Spar.

Before the blow-pipe, Celestine decrepitates and melts, without perceptibly coloring the flame, into a white friable enamel. It loses its transparency on being heated, and acquires a caustic taste different from that of Heavy Spar under similar circumstances. Reduced to powder, it phosphoresces upon red hot iron.

2. *Analysis.*

By Klaproth.

Strontia	56·00
Sulphuric acid	44 00

3. Celestine is rarely found in greywacke: its usual localities are in transition limestone, sandstone and trap rocks; in which it occurs in single kidney-shaped masses, in large massive concretions, and in vesicular cavities. Other deposits are in gypsum beds, alternating with marl and clay, and associated with sulphur.

4. The handsomest prismatic-shaped crystals, and massive columnar varieties, occur in the Sulphur mines of Sicily; also under the same circumstances at Bex in Switzerland, and Conil near Cadiz in Spain. Tabular crystals and lamellar compositions are found in beautiful varieties at Monte Viale, near Verona, and in the Bristol Channel in England. Fine varieties occur in the Seiseralpe in the Tyrol. The blue varieties occur in greywacke at Leogang in Salzburg, and at Meudon, near Paris. The blue columnar varieties occur at Dornburg near Jena. The compact is found in the tertiary of Montmartre near Paris. Magnificent crystallizations of Celestine of a delicate blue color have been found in the secondary limestone bordering on lake Erie: particularly at a place called Strontian Island in that lake. Columnar, as well as lamellar, varieties, are found under similar circumstances at Lockport and Scoharie, (N.Y.)

CEREOLITE. (See *Kerolite.*)

CERINE. (See *Allanite.*)

CERITE. Uncleavable Eruthrone-Ore.

Regular forms and cleavage unknown.

Lustre adamantine. Color intermediate between clove-brown and cherry-red, passing into grey. Streak white. Translucent on the edges.

Brittle. Hardness = 5·5. Sp. gr. = 4·912.

Compound Varieties. Massive: composition granular, individuals not distinguishable; fracture uneven and splintery.

1. Alone before the blow-pipe, it is infusible; but with borax forms an orange-yellow globule, which becomes paler on cooling. With soda it does not perfectly dissolve; but forms a semi-fused, dark yellow mass.

2. *Analysis.*

By HISINGER.

Oxide of cerium - - -	68·59
Silica - - -	18·00
Oxide of iron - - -	2·00
Lime - - -	1·25
Water and carbonic acid - -	9·60

3. This rare mineral occurs in a bed of gneiss at the copper mine of Nya Bastnaes, near Riddarhyttan, Westmoreland, in Sweden. It is accompanied by Bismuthine and Mica.

CHABASIE. Rhombohedral Kouphone-Spar. MOHS.

Primary form. Rhomboid. P on P = 94° 46′.

Secondary forms.

Fig. 127.

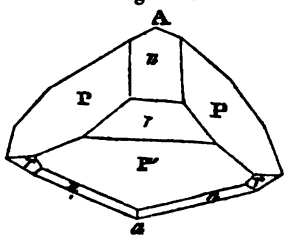


Fig. 128.

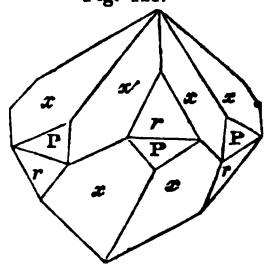


Fig. 127, the primary, having the upper edges and the lateral angles replaced by tangent planes. P on r = 120° 5′. n on r=143° 59′. Fig. 128, the same, in which the edges between P and r are replaced by the planes x. x on x'=173° 32′. x on x' (over the base) =96° 40′. P on x=175° 30′.

Cleavage parallel to the primary rhomboid, but not distinct. Fracture uneven. The faces P are generally striated parallel with the upper edges of the rhomboid.

Chabasie.

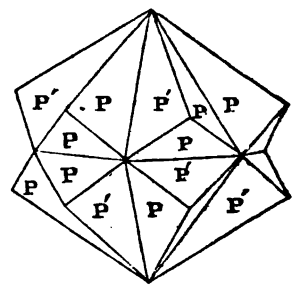
Lustre vitreous. Color white or reddish white: rarely yellowish white. Streak white. Semi-transparent . . . translucent.

Brittle. Hardness =4·0 . . . 4·5. Sp. gr.=2·100, crystals from Bohemia.

Compound Varieties. Twin-crystals.

In this figure the face of composition coincides with the vertical axis; and the angle of revolution = 80°. Fig. 127, in place of the primary, sometimes enters into composition in the same way. Massive: composition granular, of various sizes; faces of composition uneven.

Fig. 129.



1. Alone before the blow-pipe, it melts into a white blebby mass. It is not acted on by the acids.

2. *Analysis.*

	By Berzelius, from Gustavusberg.	By Arfwedson, from Fassa.	
Silica	50 65	48·38	49·07
Alumina	17·90	19·28	18·90
Water	19 90	21·40	19·73
Lime	9·37	8 70	
Potash	1·70	2·50	12·19 with soda.

3. Chabasie chiefly occurs in the cavities of amygdaloidal rocks. It has been found also in seams between the layers of gneiss and mica-slate. It is accompanied by Stilbite, Laumonite, Calcareous Spar and Quartz.

4. The largest and most distinct crystals are found in Iceland, the Faroe islands, and the vicinity of Aussig in Bohemia. Other localities are Altenberg near Oberstein in Saxony, Talisker in the isle of Skye, Glen Fary in Perthshire in the north of Ireland, and near Swan's creek in the Basin of Mines, Nova Scotia. At this last named place it occurs of a

wine yellow or flesh-red color, in crystals of various sizes, and often highly modified: they exist in the cavities of amygdaloidal rocks, accompanied by Analcime, Calcareous Spar and Heulandite. In the United States, Chabasie is occasionally met with in the trap region of the Connecticut river; also in seams between the layers of a mica slate rock at Chester, (Mass.) and at Baltimore, (Maryland,) under similar circumstances. It occurs on gneiss with Stilbite, at Hadlyme, (Ct.)

CHALKOLITE. (See *Uranite.*)

CHALKOPYRITE. (See *Yellow Copper-Ore.*)

CHALKOSIDERITE.

In very thin tabular crystals: stalactitic and drusy. Fracture fibrous and foliated. Color green, mostly yellowish. Lustre pearly. "Half-hard." Sp. gr. = 3·392.

CHALKOSINE. (See *Vitreous Copper.*)

CHALKOTRICHITE.

The capillary variety of *Red Copper-ore.* q. v.

CHAMOISITE.

Massive; composition impalpable, or oolitic.
Color greenish-grey.
Scratched by the point of a knife. Sp. gr. = 3·0 . . . 3·4.

1. It yields moisture when heated in a glass tube, at the same time assuming a blacker color, and becoming more magnetic. It dissolves in the strong acids, leaving behind a portion of gelatinised silica.

2. *Analysis.*

By BERTHIER.

Silica - - - -	14·3
Alumina - - - -	7·8
Protoxide of iron - - - -	60·5
Water - - - -	17·4

In addition to the above, it contains variable proportions of carbonate of lime and magnesia.

3. It occurs in beds of moderate thickness in the limestone mountain of Chamoison in the Vallais, France.

4. It is explored with profit as an ore of iron.

5. The Chamoisite appears to be an impure variety of Magnetic Iron-Ore.

Childrenite—Chlorophaeite.

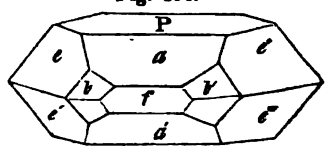
CHILDRENITE.

Primary form. Right rhombic prism. M on M′ = 92° 48′.

Secondary form.

P on *e* or *e*″	- -	114°	50′
P on *a*	- -	152	10
P on *f*	- -	90	00
e on *e*′	- -	130	20

Fig. 130.



Cleavage, imperfect, parallel to P. Fracture uneven.

Lustre vitreous, inclining to resinous. Color yellowish white, wine-yellow, ochre-yellow, and pale yellowish-brown.

Streak white. Translucent.

Hardness = 4·5 . . . 5·0.

1. Dr. WOLLASTON found this mineral to be a compound of phosphoric acid, alumina, and iron.

2. It has hitherto been found only in the neighborhood of Tavistock, disposed in rough crystals and crystalline coats on Spathic Iron, Iron Pyrites and Quartz, occasionally accompanied by Fluor.

3. Childrenite approaches in several of its properties the species Lazulite, the planes *a a* of whose crystals may be considered as corresponding to M M of Childrenite.

CHLORITE. (See *Talc.*)

CHLOROMELAN. (See *Cronstedite.*)

CHLOROPAL. (See *Opal.*)

CHLOROPHÆITE.

Massive: in small grains, imbedded in basalt or trap, and sometimes hollow. Fracture conchoidal . . . nearly earthy.

Color pistachio green, and translucent or opake; but soon turning into brown and black on being exposed to the air, without losing its lustre: the same effect takes place in a longer time, to the depth of an inch or two, into the rock.

Brittle. Hardness, scratched by a quill. Sp. gr. = 2·020.

1. Before the blow-pipe, it remains nearly unchanged, altering neither its color nor transparency. Besides silica, it contains iron and a little alumina. It occurs in Scuirmore cliff in the island of Rum, also in Fife-

shire and in Iceland. It has been found at several places in the United States, among which may be mentioned those of Gill, (Mass.) and Southbury, (Conn.)

2. It appears to be decomposed Mesotype.

CHONDRODITE. (See *Brucite.*)

CHRISTIANITE. (See *Anorthite.*)

CHROMATE OF LEAD. (See *Red Lead-Ore.*)

CHROME-OCHRE. Chromic Lusine-Ore.

Massive: composition impalpable: earthy and pulverulent.

Color dark green.

1. Infusible before the blow-pipe, but changes to a lighter green. With borax, it gives a fine green color.

2. *Analysis.*

Oxygen - - - - - -	29·89
Chrome - - - - - -	70·11

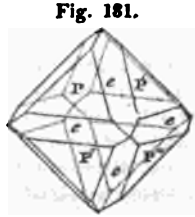
3. It sometimes occurs pure, but more frequently mingled with earthy matters, as in the mountains of Ecouchets, between Conches and Creuzot, Saone and Loire. Also with Feldspar at Elfdalen in Dalecarlia, and in serpentine rocks in the Alps of Savoy and Piedmont.

CHROME-ORE. Chromated Iron-Ore.

Primary form. Regular octahedron.

Secondary form.

Fig. 181.



Hoboken, (New Jersey,) and Bare Hills, (Maryland.)

Cleavage parallel with the primary form rather imperfect. Fracture uneven, or imperfectly conchoidal.

Chrome-Ore.

Lustre imperfectly metallic. Color between iron-black and brownish-black. Streak brown. Opake.

Brittle. Hardness = 5·5. Sp. gr. =4·498, a variety from Stiria.

Compound Varieties. Massive: composition granular, the individuals being of various sizes, and generally firmly connected.

1. Alone before the blow-pipe, it is infusible, but acts upon the magnetic needle after having been exposed to the reducing flame. It is with difficulty wholly soluble in borax, to which flux it imparts a beautiful green color.

2. *Analysis.*

	By Vauquelin.	By Klaproth.
Oxide of chrome	43·00	55·50
Protoxide of iron	34·70	33·00
Alumina	20·30	6·00
Silica	2·00	2·00

3. The varieties of Chrome-Ore have been hitherto found only in serpentine, in irregular veins and beds, which appear to be of contemporaneous formation with the rock itself.

4. This species was first found in the department of du Var in France, where it formed nodules and kidney shaped masses. In Stiria it occurs in the Gulsen mountain near Kraubat, in serpentine, in very irregular veins. Other localities are, Portsoy in Banffshire, and at Buchannan in Stirlingshire, in Scotland; in the latter place imbedded in limestone: at Unst and Fetlar in the Shetland isles, in Silesia, Bohemia and the Uralian mountains. In the United States a very abundant deposit exists at the Bare Hills near Baltimore, where it occurs in veins or masses in serpentine. The crystals are found at the same place in channels worn by water about the base of the hill. At Hoboken in New Jersey, it is found both massive and in crystals, imbedded in Serpentine and Dolomite; and under similar circumstances at Milford and West Haven, (Conn.)

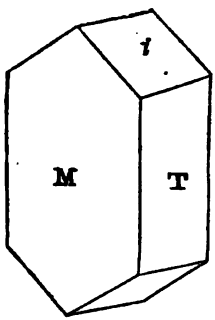
5. The Chrome-Ore is highly valuable for extracting the oxide of chrome, which is employed either alone, or in various combinations with the oxides of other metals, as cobalt, lead, mercury, &c., both for painting on porcelain, and for painting in oil. It yields green, yellow and red pigments.

CHRYSOBERYL. Prismatic Emerald.

Primary form. Right rectangular prism.

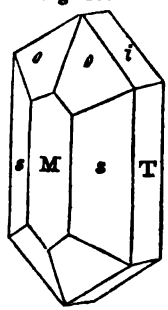
Secondary forms.

Fig. 132.



Haddam, (Conn.)

Fig. 133.



Siberia.

Fig. 134.

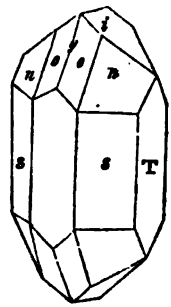


Fig. 132, the primary having the terminal plane obliterated by the extension of the planes *i*, which replace the shorter terminal edges. *i* on *i* = 120°, *anamorphique* of Hauy.—Fig. 133, in addition to the new planes *i*, the terminal angles and the lateral edges are replaced. *o* on *i* = 133° 19′, H. *o* on M = 136° 41′, H. M on *s* = 125° 16′.—Fig. 134 is the *octovigésimale* of Hauy. *n* on *o* = 163° 53′ H. T on *n* = 126° 8′ H.

Cleavage distinct parallel to the primary form; effected with ease parallel to M, but with difficulty in the direction of T and P. Traces of a diagonal cleavage. Fracture conchoidal. Surface, the vertical planes striated longitudinally; the remaining ones generally smooth and even.

Lustre vitreous. Color asparagus-green, passing into greenish-white, olive green, and yellowish-grey. Streak white. Transparent... translucent: sometimes exhibiting

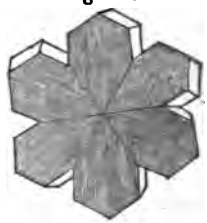
a bluish opalescence when viewed perpendicular to the narrow lateral plane of the primary.

Hardness=8·5. Sp. gr. =3·754, a transparent variety.

Compound Varieties. Twin-crystals: face of composition perpendicular, axis of revolution parallel to the edge formed by the meeting of planes *i* and T, Fig. 132; angle of revolution=60°.

Fig. 135.

Fig. 136.



In Fig. 135, the crystals project beyond the face of composition only at one extremity; it is rare to find them projecting at both extremities, although these do sometimes occur at Greenfield, (N.Y.) Occasionally the sides 1 are so deeply replaced as to convert the macle into a triangular prism; and when this is the case, the re-entering angle at *a* is not visible, the composition being detected only by the striæ. In Fig. 136, three prisms cross each other, or the composition is repeated; and the prisms project at each end beyond the faces of composition. Rarely crystals are found, in which they project only at one end, in which case the form which results is represented by the upper half of Fig. 136; and still more rarely they are found in which they project at neither extremity, when a regular hexagonal table is produced.

1. It remains unchanged, if exposed alone or with soda to the heat of the blow-pipe, only the surface in the latter case becomes dull. It is with difficulty fusible with borax and salt of phosphorus.

2. *Analysis.*

	By Seybert, fr. Haddam.	By Seybert, fr. Brazil.	By Thomson and Muir, fr. Brazil.
Alumina	73·60	68·666	76·752
Glucina	15·80	16·000	17·791
Silica	4·00	3·999	0·000
Protoxide of iron	3·38	4·733	4·494
Oxide of titanium	1·00	2·666	0·000
Moisture	0·40	0·666	0·480

3. Chrysoberyl is found in granite veins associated with Tourmaline, Beryl and Garnet: also in the alluvial deposits of rivers, along with other species of gems.

4. It occurs in Brazil along with Diamond and Topaz, also in Ceylon; in which places it has been found only in sand. The most interesting deposits of this species are in the United States, at Haddam, (Conn.) and Greenfield, near Saratoga, (N.Y.) At the former place it is associated with Garnet, Beryl, Automalite and Columbite; and at the latter with Tourmaline, Garnet and Apatite. In both cases it exists in granite, traversing gneiss in veins.

CHRYSOCOLLA. Staphyline Malachite-Haloide.

Regular forms unknown. Cleavage none. Fracture conchoidal.

Color emerald-green, pistachio-green, asparagus-green, passing into sky-blue. If they incline to brown, the mineral is impure. Streak white, a little shining. Semi-transparent . . . translucent on the edges.

Rather sectile. Hardness = 2·0 . . . 3·0. Sp. gr. = 2·031, a semi-transparent variety.

Compound Varieties. Botryoidal, reniform shapes or massive varieties: composition impalpable; fracture more or less perfectly conchoidal. Pseudomorphoses in the shape of Red Copper-Ore and of Copper-Mica. Impure varieties are often earthy.

Chrysocolla.

1. Before the blow-pipe, upon charcoal, it first becomes black; and in the inner flame, red, without melting. With borax, it melts into a green glassy globule, and is partly reduced, as the metallic particles which this globule contains, evince. If pure it is soluble in nitric acid, without effervescence, and leaves a residue of silica.

2. *Analysis.*

	By KLAPROTH.	By JOHN.	By BOWEN, from N. Jersey.
Copper	40·00	42·00	45·175
Oxygen	10·00	7·63	
Silica	26·00	28·37	37·250
Water	17·00	17·50	17·000
Carbonic acid	7·00	3·00	0·000
Sulphate of lime	0·00	1·50	0·000

3. The natural repositories of Chrysocolla are those of other ores of copper, where it is found along with them, and also with Brown Iron-Ore and Quartz.

4. It occurs at Saalfield in Thuringia, at Lauterberg in the Hartz, at Saska and Moldawa in the Bannat, at Herrengrund in Lower Hungary, at Falkenstein and Schwatz in the Tyrol, in the Lizard district in Cornwall; in Norway, Siberia, Mexico and Chili. In the United States, at a copper mine in Sommerville, (New Jersey,) Chrysocolla is found accompanying Red Copper-Ore, Native Copper, and Green Malachite. In Nova Scotia, at the Basin of Mines, associated with other ores of copper, and with Brown Iron-Ore.

CHRYSOLITE. (See *Olivine.*)

CHRYSOPRASE. (See *Quartz.*)

CHUSITE. (See *Olivine.*)

CIMOLITE.

A pearl, or reddish grey clay, tender to the feel, and falling to pieces in water. It consists, according to KLAPROTH, of

Silica	63·00
Alumina	23·00
Water	12·00
Oxide of iron	1·25

It is not known from the decomposition of what mineral it is derived. It occurs at Argentiera, (Cimolis,) an island in the Grecian Archipelago.

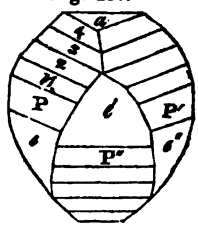
CINNABAR. Peritomous Melacone-Blende.

Primary form. Rhomboid. P on P′ = 72°.

Secondary form.

P on P′	-	-	-	71°	48′
P on *b*2	-	-	-	157	20
P on *b*3	-	-	-	152	8
P on *e*	-	-	-	159	18
a on *b*1	-	-	-	127	5
a on *b*2	-	-	-	133	25
a on *b*3	-	-	-	138	34
a on *b*4	-	-	-	146	31
e on *b*1	-	-	-	142	55
e on *b*3	-	-	-	131	26

Fig. 137.



Cleavage parallel to the primary form, highly perfect. Fracture conchoidal. Surface of the crystals horizontally streaked, sometimes very deeply.

Lustre adamantine, inclining to metallic in dark colored varieties. Color several shades of cochineal-red, the darker varieties inclining to lead-grey. Streak scarlet-red. Semi-transparent . . . translucent on the edges.

Sectile. Hardness = 2·0 . . . 2·5. Sp. gr. = 8·098, the cleavage variety from Neurmarktel.

Compound Varieties. Twin-crystals. like Fig. 84, of the compound varieties of *Calcareous Spar*. Rarely in some indistinct imitative shapes. Massive: composition granular, of various sizes of individuals, generally small and often impalpable. In the last case, fracture becomes uneven, even, or flat conchoidal. Plates, superficial coatings. There is sometimes a tendency to thin columnar composition, the mass being friable, and the color scarlet red.

Cinnabar.

1. The *Hepatic Cinnabar* is a compound variety of Cinnabar, which is impure, and having on that account a streak inclining to brown. The *dark red* Cinnabar includes the crystals, and those compound varieties in which the individuals are still discernible; it is generally cochineal-red. The *bright red* Cinnabar is friable, and of a scarlet-red color. The *compact* Hepatic Cinnabar contains reniform massive varieties of a granular composition, consisting of impalpable individuals. The *slaty* Hepatic Cinnabar is the same thing; only interrupted by irregularly streaked smooth faces, which possess a slaty appearance. These however are accidental, not having any relation to the composition itself. The *Bituminous Cinnabar* consists of Cinnabar, intermixed with coarse coal or bituminous shale.

Before the blow-pipe, the pure varieties are easily volatilized. It is soluble in nitric acid. On being sublimated, it crystallizes in columnar masses.

2. *Analysis.*

By Klaproth.

Mercury	84·50	85·00
Sulphur	14·75	14·25

3. Cinnabar chiefly occurs in beds, accompanied by Native Mercury, Native Amalgam, and sometimes only by Calcareous Spar and Quartz. Some of its varieties have been found in veins, where they occur along with several ores of iron.

4. It occurs in beds in gneiss, at Richenaw in Upper Carinthia, and at Hartenstein in Saxony; also at Dumbrawa in Transylvania, in greywacke. It is found included in irregular veins, situated in beds of limestone, at Harmagor, Windisch-Kappel, and other places in Carinthia, but particularly at Neumarktel in Carniola, the Palatinate, and Almaden in Spain. At Idria, it occurs in beds of bituminous shale, with Bitumen and dark grey sandstone, associated with limestone. Other localities are Schemnitz, Cremnitz, and Rosenau in Hungary, at Horzowitz in Bohemia, in the Erzberg, near Eisenerz in Stiria. The Hepatic Cinnabar has been found only at Idria; the bright-red Cinnabar at Wolfstein in the Palatinate. Cinnabar likewise abounds in Mexico and Peru, in China and Japan.

5. It is used for the extraction of mercury; if very pure, it is employed as a pigment in its natural state.

Clausthalite.

CLAUSTHALITE. Paratomous Polypoione-Glance.

Massive: individuals granular: the larger ones having one bright cleavage; also in minute lamellar masses.

Lustre metallic. Color lead-grey, with a tinge of blue. Streak dark grey.

Hardness, below Galena. Sp. gr. = 6·8.

1. Heated in a glass tube before the blow-pipe, the selenium sublimes and fills the upper part of the tube with crystals of selenic acid. Upon charcoal it smokes, and tinges the flame of the blow-pipe blue. Cold nitric acid, after some time, causes the mass to assume a red color in consequence of the separation of selenium.

2. *Analysis.*

	By Rose.	By Stromeyer.
Lead	72·3	70·98
Selenium	27·7	28·11
Cobalt	00·0	0·83

3. It is found in the eastern part of the Hartz, at several places not far apart, one of which is Lorenz, near Klausthal; another is near Zorge, in the veins of iron-ore which traverse the argillite; and another still is near Tilkerode. The mineral is contained in a dolomite or argillite, accompanied by Malachite and Quartz.

Appendix to Seleniuret of Lead.

i. *Seleniuret of Lead with Seleniuret of Cobalt.*

Sp. gr. = 7·697. Found by Rose to contain

Lead	63·92
Cobalt	3·14
Selenium	31·42
Iron	0·45
Loss	1·07

It is found near Klausthal, engaged in dolomite.

ii. *Seleniuret of Lead with Seleniuret of Copper.*

Sp. gr. = 5·0 . . . 7·0. Analysis by Rose.

Selenium	29·96
Iron with traces of lead	0·44
Lead	59·67
Iron	0·33
Copper	7·86
Undecomposed and loss	1·74

Another sample gave,

Selenium - - -	34·26
Copper - - -	15·45
Lead - - -	47·43
Silver - - -	1·29
Oxide of lead and iron - - -	2·08

From Tilkerode, in veins of dolomite with Malachite.

iii. *Seleniuret of Lead and Mercury.*

Sp. gr. = 7·3.

Selenium - - -	24·97
Lead - - -	55·84
Mercury - - -	16·94
Loss - - -	2·25

It gives when heated in an open tube a yellow sublimate of the seleniate of mercury.

It is found at the mine Tilkerode, engaged in dolomite.

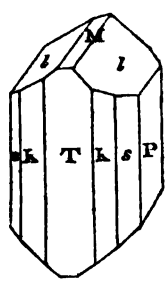
CLEAVELANDITE. (See *Albite.*)

COBALT-BLOOM. Diatomous Cobalt-Mica.

Primary form. Right oblique-angled prism. M on T = 124° 51′.

Secondary form.

Fig. 138.



The greater terminal edges are replaced by single planes, and the lateral edges by two planes. *k* on *k* = 130° 10′. *s* on *s* = 94° 12′. *l* on *l* = 118° 23′.

Cobalt-Bloom.

Cleavage, parallel to P perfect: that parallel with M and T scarcely visible. Surface, P and T streaked vertically.

Lustre upon P pearly, particularly if produced by cleavage. The rest of the faces possess adamantine lustre inclining to vitreous.

Color, crimson-red, cochineal-red, peach blossom-red, sometimes pearl-grey or greenish grey. The red tints of the former, by transmitted light, incline much more to blue if seen in a direction perpendicular to P. Streak corresponding to the color, though a little paler. If the mineral be crushed into powder in a dry state, this powder possesses a deep lavender-blue tinge, which is not the case if the powder be comminuted in water. Transparent to translucent on the edges. Crystals are least transparent in a direction perpendicular to P.

Sectile; thin laminæ are flexible in one direction. Hardness $=1\cdot5\ldots2\cdot0$; the lowest degrees are upon P. Sp. gr. $=2\cdot948$, a red crystallized variety from Schneeberg.

Compound Varieties. Implanted globular and reniform shapes; surface drusy; composition more or less perfectly columnar of various sizes of individuals, faces of composition either smooth or rough. Massive, composition columnar, often stellularly divergent, and aggregated in a second granular composition, faces of composition rough. Sometimes in a state of powder, as a coating upon other minerals.

1. Alone, before the blow-pipe, it assumes a darker hue. Upon charcoal, it emits copious arsenical fumes, and melts in the inner flame, into a bead of arseniuret of cobalt. With borax and other fluxes, it yields a fine blue colored salt.

2. *Analysis.*

By BUCHOLZ.

Oxide of cobalt - - - -	39·00
Arsenic acid - - - -	37·00
Water - - - -	22·00

3. Cobalt-bloom occurs in veins, traversing rocks of various ages, and also in beds. It is accompanied by Copper Nickel, Smaltine, Native Bismuth, Malachite, Quartz and Calcareous Spar.

4. The principal localities of this species are Schneeberg and Annaberg in Saxony, and Platten in Bohemia, where it occurs in veins in primitive rocks; Saalfeld in Thuringia, Riegelsdorf and Bieber in Hessia, where it is found in veins in secondary mountains. Other locatities are Würtemberg in Prussia, Tyrol, Norway, Sweden, Cornwall and Scotland.

5. When in sufficient quantity, it is employed in the manufacture of smalt.

COBALTINE. Hexahedral Eruthleucone-Pyrites.

Primary form. Cube.

Secondary forms.

1. Cube with its angles replaced by tangent planes.
2. Regular octahedron.
3. Regular octahedron with its solid angles replaced by tangent planes.

Fig. 139.

4.

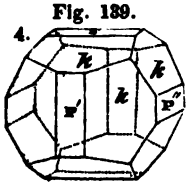


Fig. 140.

5.

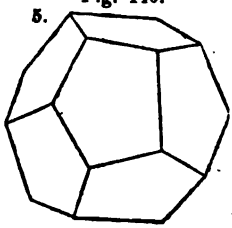
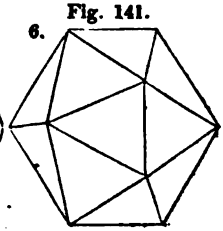


Fig. 141.

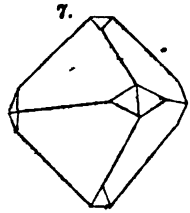
6.



Cobaltine.

Fig. 142.

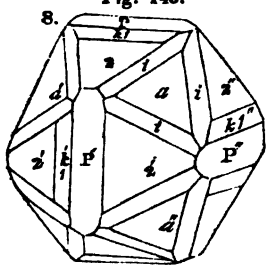
7.



Differing from fig. 139 by the reduction of the irregularly six-sided planes *k*, to small triangles.

Fig. 143.

8.



P on P′ or P″ . . .	90°	00′	00″	00‴	H.
a on *a*′ or *a*″ . . .	109	28	16	00	P.
P′ or P″ on *a* . .	125	15	52	00	P.
P on *k*1, P′ on *k*1′, or P″ on *k*2″	166	30	00	00	P.
P on *k*2, P′ on *k*2′, or P″ on *k*2″	153	26	5	30	H.
a or *a*′ on *k*2 . . .	140	46	17	00	P.
a on *i* . . .	163	27	00	00	P.
*k*2′ on *k*2′ . . .	126	52	11	00	H.

The above crystals, all from Tunaberg, (Sweden.)

Cleavage parallel with faces of the cube, perfect. Fracture imperfectly conchoidal, uneven. Surface, the faces of the cube streaked in three directions perpendicular to each other. The remaining faces smooth.

Lustre metallic. Color silver-white, inclining to red. Streak greyish-black.

Cobaltine—Cobalt Vitriol.

Brittle. Hardness = 5·5. Sp. gr. = 6·298.

Compound Varieties. Massive: composition granular, generally small, but easily discernible.

1. Before the blow-pipe, upon charcoal, it gives a large quantity of arsenical fumes, and melts only, after having been roasted. It imparts a blue color to borax and other fluxes. It affords a pink solution with nitric acid, leaving a white residue, which is itself dissolved on further digestion.

2. *Analysis.*

	By KLAPROTH, fr. Tunaberg.	By TASSAERT, fr. Tunaberg.	By STROMEYER, fr. Modum.
Cobalt	44·00	36·00	33·10
Arsenic	55·50	49·00	43·46
Iron	0·00	5·66	3·23
Sulphur	0·50	6·50	20·08

3. It occurs in beds in primitive rocks, and in veins. It is accompanied chiefly by Iron Pyrites, Mispickel, and Copper Pyrites; in beds, it is also associated with Magnetic Iron-Ore, Pyroxene, Hornblende, and Feldspar; in veins it is sometimes found with limestone and Heavy-Spar. The crystals found in beds are terminated on all sides.

4. This species occurs in the parish of Modum in Norway, at Tunaberg in Südermanland in Sweden, at Querbach in Silesia, and Bottallack near St. Just in Cornwall.

5. It is a valuable ore of cobalt, which metal is employed for painting in porcelain and the manufacture of smalt.

COBALT VITRIOL. Staphyline Vitriol-Salt.

Stalactitic and coralloidal shapes: composition columnar, in most cases impalpable. Friable.

Lustre vitreous: in very thin columnar compositions, it becomes pearly. Color flesh-red and rose-red ... reddish white. Semi-transparent ... translucent.

Taste astringent.

1. It communicates to borax a blue color; and is soluble in water.

2. *Analysis.*

By KOPP.

Oxide of cobalt	38·71
Sulphuric acid	19·74
Water	41·55

3. It occurs in the rubbish of old mines at Bieber in the neighborhood of Hanau.

COCCOLITE. (See *Pyroxene.*)

COLLYRITE.

Massive: composition impalpable. Color white. More or less translucent. Fracture conchoidal, with resino-vitreous lustre. Easily impressed by the nail, and shining when cut with the knife. Adheres strongly to the tongue.

1. Infusible before the blow-pipe, affording water by calcination, and at the same time becoming pulverulent. Forms a jelly in the acids.

2. *Analysis.*

	By KLAPROTH, from Chemnitz.	By BERTHIER, from Esquera.
Silica	14·0	15·0
Alumina	45·0	44·5
Water	42·0	40·5

3. It occurs in narrow seams in porphyry at Schemnitz, in the lead mines of Esquera in the Pyrenees, and at Weissenfels in Saxony.

COLOPHONITE. (See *Garnet.*)

COLUMBITE. Pyramidal Baryte-Ore.

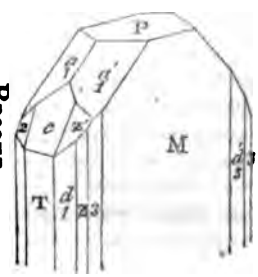
Primary form. Right rectangular prism.

Secondary form.

P on M or T	-	90°	00′
M on T	-	90	00
P on *a*1 or *a*1′	-	136	30
P on *c*	-	120	00
T on *d*1	-	156	30
T on *d*2	-	114	30
T on *c*	-	150	00

BROOKE.

Fig. 144.



Columbite.

Cleavage parallel with M and T rather distinct, especially that of M: the cleavage parallel with P less obvious. Fracture imperfectly conchoidal, uneven. Surface, M and T vertically streaked.

Lustre imperfectly metallic. Color greyish and brownish-black. Streak dark brownish-black, on the file a little shining. Opake.

Brittle. Hardness = 6·0. Sp. gr. = 6·038.

Compound Varieties. Massive: composition granular.

1. Upon charcoal, it suffers no change before the blow-pipe, but it melts with borax, and is partly soluble in heated sulphuric acid.

2. *Analysis.*

	By Berzelius.			By Vogel.	By Borkowsky,
	fr. Kimito.	fr. Finbo.	fr. Brodbo.		fr. Bodenmais.
Columbic acid	83·2	66·99	68·22	75·00	75·00
Tungstic acid	0·0	0·00	6·19	0·00	0·00
Protoxide of iron	7·2	7·06	8·60	17·50	20·00
Protoxide of manganese	7·4	7·44	6·62	1·09	4·00
Oxide of tin	0·6	16·75	8·26	1·00	0·50
Lime	a trace.	2·40	1·19	0·00	0·00

The Columbite of Chesterfield, (Mass.) consists of the oxides of columbium, tin, iron and manganese, with a trace of lime.

3. Columbite occurs in granite veins, usually attended by Beryl.

4. It is found at Bodenmais in Bavaria, associated with Beryl and Uranite, where it exists in very distinct crystals. Also at Finbo and Brodbo near Fahlun in Sweden, with Topaz, Albite, and Quartz. It has been met with at several other places in Sweden and Finland.

Columbite was first discovered near New London, (Conn.) and the specimens sent by Gov. Winthrop to Sir Hans Sloane. The original locality has never since been re-discovered; but the mineral was subsequently found at Haddam in the well known Chrysoberyl deposit, which place still affords fine specimens of it, though in very limited quantity. More distinct crystals, and of greater magnitude, come from Chesterfield, (Mass.) where it exists along with variously colored Tourmalines and Beryl in granite. The most perfect crystals, as well as the largest

of this species which the United States have afforded, have been found at Acworth, (New Hampshire,) but the locality appears to be exhausted.

APPENDIX TO COLUMBITE.

Brown Tantalite of Kimito. BERZELIUS.

Sp. gr. = 7·9. Powder cinnamon-brown.

When heated with borax, in a very fine powder, it is with difficulty dissolved. The glass does not possess the color of the oxides of iron, except a dark green color, which exists only during the experiment. With salt of phosphorus, it is readily dissolved. It becomes minutely divided with soda, but does not dissolve, giving in the reduction flame a little tin, and upon platina-foil the reaction of manganese.

2. *Analysis.*

By BERZELIUS.

Columbic acid . . .	82·56
Protoxide of iron . . .	14·41
Protoxide of manganese . .	1·79
Oxide of tin . . .	0·56
Silica . . .	0·72

It is probable that future researches may render it necessary to divide the species Columbite, but at present our knowledge of the properties of its varieties do not justify the procedure.

COMMON SALT. Hexahedral Rock-Salt. MOHS.

Primary form. Cube.

Secondary forms.

Fig. 145.

1.

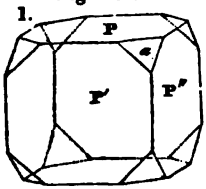
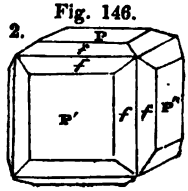


Fig. 146.

2.



3. Octahedron.

Cleavage, parallel with the cube, perfect; rarely also the crystals cleave parallel with the diagonals of this form.

Common Salt.

Fracture conchoidal. Surface generally smooth.

Lustre vitreous, somewhat inclining to resinous. Color generally white, passing into yellow, flesh-red and ash-grey. Sometimes beautifully violet, berlin or azure-blue. Streak white. If scratched with the nail, it does not yield any powder, but receives an impression, and becomes a little shining. Transparent... translucent.

Rather brittle. Hardness = 2·0. Sp. gr. = 2·257, a yellowish-white transparent variety. Taste saline.

Compound Varieties. Dentiform and some other imitative shapes, rare. Commonly massive. Composition granular or columnar, the latter in most cases parallel, sometimes curved. Size of the component individuals various. Faces of composition rough.

1. Several varieties in the geological relations, and some differences in the chemical composition, have given rise to the subdivision of Common Salt into subspecies in the older books. Thus the varieties found in beds have been called *Rock-salt;* such as are found at the bottom of salt lakes, or on their shores, *Sea-salt;* and the former again have been divided into *foliated* and *fibrous* Rock-salt, according to their granular or columnar mode of composition.

Common salt is very easily soluble in water. It remains unaltered, if exposed to the dry atmosphere, and decrepitates upon glowing charcoal, or before the blow-pipe. It crystallizes, both from solutions in water, and from fusion. It undergoes a remarkable change if exposed to a moist atmosphere, in consequence of the absorption of water. The solution of a mass of a cubical shape begins regularly at its edges, and transforms the cube first into a cube with its edges bevelled, and finally into the icositetrahedron with triangular faces. (fig. 124. Part I.) In the latter form, the mass of the salt diminishes in size, till at last it is entirely dissolved.

2. *Analysis.*

By Henry. [*Rock-salt* variety.]

Muriate of soda . . .	983·25
Sulphate of lime . . .	6·50
Muriate of magnesia . . .	0·19
Muriate of lime . . .	0·06
Undissolved matter . .	10·00

3. Common salt occurs chiefly in beds, some of which are of considerable dimensions, though commonly of an irregular form, and is met with in secondary rocks, accompanied by gypsum, sandstone and clay. It is likewise found at the bottom and in the vicinity of salt lakes, in the waters of which it is dissolved. It is contained in the waters of salt springs, of several mineral wells, and of the sea, though in variable quantities. It occurs upon certain varieties of lava, and in some volcanic lakes.

4. In the solid state, it exists in large quantity in Poland, Hungary, Transylvania, Moldavia, and Walachia, in Stiria, Upper Austria, Salzburg, the Tyrol, Bavaria, Würtemberg and Switzerland; also in England and Spain, and numerous other countries in and out of Europe. In several of these countries, and also in several of the United States, Common Salt exists abundantly in salt springs, from which it may be obtained by means of evaporation. The variety sea-salt is found in the Crimea, in the deserts of the Caspian Sea, in Egypt, and in several places in Southern Africa and America.

5. The employment of common salt for culinary purposes, in different arts and manufactures, is too familiar to need enumeration.

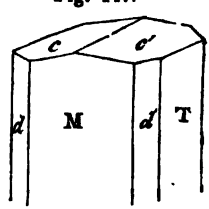
COMPTONITE. Vesuvian Kouphone-Spar.

Primary form. Right rectangular prism.

Secondary form.

M on T	-	90°	00′	Phillips.
T on *c′*	-	93	00	
c on *c′*	-	107	05	
M on *d′*	-	135	35	

Fig. 147.



Cleavage parallel to T and M, the first a little more distinct; also parallel to the diagonal. Fracture small conchoidal, uneven. Surface *d* striated parallel to the edges of combination with M and T. The remaining faces smooth.

Comptonite.

Lustre vitreous. Color white. Streak white. Transparent . . . semi-transparent.

Hardness = 5·0 . . . 5·5.

1. Before the blow-pipe it gives off water, intumesces a little, and becomes opake; then it melts imperfectly into a vesicular glass. The globule obtained with borax is transparent, but vesicular; that obtained with salts of phosphorus contains a skeleton of silica, and becomes opake on cooling. With a little soda, it melts imperfectly; but with a larger quantity, it becomes infusible. The glass, with solution of cobalt, is dirty bluish-grey. It forms a gelatine when exposed in the state of powder to the action of nitric acid.

2. It occurs in the cavities of an amygdaloidal rock, along with Harmotome, at Mount Vesuvius.

Condurrite.

Massive: composition columnar, dividing into irregular portions like starch. Fracture flat conchoidal.

Lustre metallic. Color brownish-black. Sometimes highly polished, with a tinge of blue. In powder, soot black.

Hardness, does not scratch glass; is brittle, but yields to the knife, leaving a polished metallic-looking surface nearly of a lead-grey color.

1. A fragment placed on a red-hot coal, affords a copious white vapor, leaving behind a metallic substance, in a semi-fluid state of a yellowish color. It dissolves entirely in nitric acid.

2. *Analysis.*

By Faraday.

	Water	8·98
	Arsenious acid	25·944
Alloy of	Copper	60·498
	Sulphur	3·064
	Arsenic	1·504
	Iron	a trace.

It is probably a mechanical mixture of metallic arsenic, arseniate of copper, oxide of copper, and a little Copper Pyrites, one or more of these substances being in combination with water. Should this suggestion prove correct, it will not deserve to be ranked among the species of mineralogy.

Copperas.

3. It was discovered in the Condurrow mine at Cornwall.

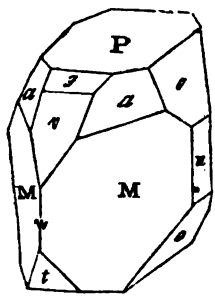
CONITE. (See *Dolomite.*)

COPPERAS. Hemi-Prismatic Vitriol-Salt. MOHS.

Primary form. Oblique rhombic prism. M on M′= 82° 20′. P on M or M′=99° 20′.

Secondary forms. The primary is almost invariably affected by slight replacements of the acute and obtuse solid angles, as well as of the acute and obtuse terminal edges. More rarely the lateral edges are removed also.

Fig. 148.



Cleavage, parallel to P perfect; that parallel to M less perfect. Fracture conchoidal. Surface generally smooth.

Lustre vitreous. Color, several shades of green, passing into white. Streak white. Semi-transparent...translucent. A faint bluish opalescence sometimes observable parallel to the faces M.

Rather brittle. Hardness =2·0. Sp. gr. =1·832 of a variety containing about 0·1 of sulphate of copper. Taste sweetish astringent and metallic.

Compound Varieties. Stalactitic, botryoidal, reniform: composition columnar; if the particles become very thin, the lustre approaches to pearly. Massive: composition granular. Pulverulent.

1. Before the blow-pipe it becomes magnetic, and colors glass of borax, green. It is easily soluble in water, and the solution becomes black on being mixed with tincture of galls. If exposed to the open air, it soon becomes covered with a yellow powder, which is persulphate of iron.

2. *Analysis.*

By BERZELIUS.

Oxide of iron	25·7
Sulphuric acid	28·9
Water	45·4

3. In most cases, the present species is produced by the decomposition of other minerals, particularly of Iron Pyrites and White Iron Pyrites; and it is therefore commonly found in such places, in which artificial heaps, constructed for that purpose, mines, or other circumstances brought about by art, have given occasion to its formation. It is also found dissolved in the waters of several mines.

4. It occurs in the Rammelsberg near Goslar in the Hartz, at Schwarzenberg in Saxony, in several mines in Schemnitz in Hungary; also in Sweden, in Spain, in different coal mines in England; at Hurlet in Renfrewshire in Scotland. In the United States, numerous localities of Copperas have been discovered, especially in New England, in which section of the country it exists in the form of crusts upon the surfaces of those mica-slate rocks, which happen to abound in Iron Pyrites.

5. Both the natural and the artificial Copperas are used in dyeing, in making ink and Prussian blue, and also for producing sulphuric acid; the residue from the distillation being red oxide of iron, is employed as a color, and for a polishing substance.

COPPER MICA. Rhombohedral Euchlore-Mica. MOHS.

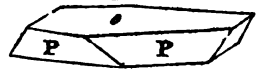
Primary form. Rhomboid. P on P = 69° 30′.

Copper Mica.

Secondary form.

The annexed figure is the primary, having the summits replaced by single planes.

Fig. 149.



Tingtang, Cornwall.

Cleavage, parallel with P, or the primary, only in traces; but parallel with *o*, with great ease. Surface, *o* smooth, sometimes striated in triangular directions. P often a little uneven.

Lustre pearly upon *o*, both as faces of cleavage, and as faces of crystallization. The faces P possess a lustre intermediate between vitreous and adamantine. Color, emerald-green and grass-green. Streak emerald-green to apple-green, rather paler than the color. Transparent... translucent.

Sectile. Hardness $=2{\cdot}0$. Sp. gr. $=2{\cdot}5488$.

Compound Varieties. Massive: composition granular of various sizes of individuals; faces of composition uneven and rough.

1. Before the blow-pipe, it loses both color and transparency, emits fumes of arsenic, and is changed into a friable scoria, containing some white metallic globules. With borax it yields a green globule, and is partly reduced. In nitric acid, it is soluble without effervescence.

2. *Analysis.*

By Chenevix.

Oxide of copper . . .	49·00
Arsenic acid . . .	14·00
Water . . .	35·00

3. The present species occurs in copper veins, along with various other ores of copper, particularly with the Liroconite, and with Brown Iron-Ore and Quartz.

4. It is found only in some of the copper mines near Redruth in Cornwall; and in minute crystals at Herrengrund in Hungary.

COPPER NICKEL. Cupreous Eruthleucone-Pyrites.

Massive: composition granular, individuals being small, and strongly connected: reniform, composition columnar, generally impalpable. Fracture uneven.

Lustre metallic. Color copper-red. Streak pale brownish-black.

Brittle. Hardness = 5·0 ... 5·5. Sp. gr. = 7·655.

1. Before the blow-pipe, it melts upon charcoal, and emits an arsenical smell. The remaining metallic bead is white and brittle. In nitric acid, it soon becomes covered with a green coating. It is soluble in nitro-murlatic acid.

2. *Analysis.*
By Pfaff.

Nickel	44·206	(with a little cobalt.)	48·96
Arsenic	54·726		46·42
Iron	0·337		0·34
Lead	0·320		0·56
Sulphur	0·401		0·80

3. The Copper Nickel chiefly occurs in veins in various classes of rocks, occasionally occurring in them as beds. It is almost always accompanied by Smaltine; sometimes also by ores of silver and lead, and often invested by Nickel-ochre.

4. The present species is found in veins at Schneeberg, Annaberg, Marienberg, Freiberg, Gersdorf and other places in Saxony; at Joachimsthal in Bohemia; at Saalfeld in Thuringia; at Riegelsdorf in Hessia; in the Hartz and Black Forest; also at Allemont in Dauphiny, and in several of the mines of Cornwall. In beds, it occurs at Schladming in Upper Stiria, and in the neighborhood of Orawitza, in the Bannat. It occurs in the United States at Chatham in Connecticut, accompanied by Smaltine in gneiss.

5. Doebereiner has observed that the metallic alloy, consisting chiefly of arsenic and nickel, which is obtained from the process of fabricating smalt, often crystallizes in four-sided tabular crystals, and is in every respect similar to Copper Nickel.

Cordierite. (See *Iolite.*)

CORNEOUS LEAD. Kerasine Lead-Baryte.

Primary form. Right square prism.

Secondary form. The primary form having its lateral and terminal edges replaced by single planes.

Cleavage, parallel to the lateral planes of the primary; cross fracture conchoidal.

Lustre adamantine. Color white and pale tints of grey, yellow and green. Streak white. Transparent to translucent.

Sectile. Hardness below 3·0. Sp. gr. =6·056.

1. Before the blow-pipe, it melts quickly into a yellow globule, which becomes white and crystallizes upon the surface, when cooling. Upon charcoal, it is reduced.

2. *Analysis.*

By Klaproth.			By Berzelius, fr. Mendip.
Oxide of lead	85 5	Lead	25·85
Muriatic acid	8·5	Oxide of lead	57·07
Carbonic acid	6·0	Carbonate of lead	6·25
Chlorine	0·0		8·84
Silica	0 0		1·46
Water	0·0		0·54

3. It is found at the Mendip hills in Somersetshire, at Matlock in Derbyshire, Hausbaden near Badenweiler in Germany, and in the United States at Southampton, (Mass.)

CORUNDUM. Rhombohedral Corundum. Mohs.

Primary form. Rhomboid. P on P′=86° 4′.

Secondary forms. 1. Regular six-sided prism. 2. The same, having the terminal edges replaced. 3. Dodecahedron with isosceles-triangular faces, the upper pyramid inclining to the lower under 121° 34′. 4. The same, with the summits replaced by single planes.

Fig. 150.

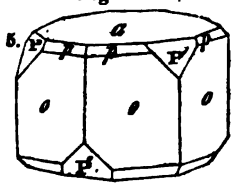
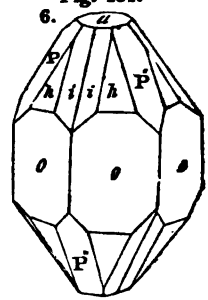


Fig. 151.



P on P′	-	-	= 86°	4′	PHILLIPS.
P on *a*	-	-	122	30	
P on *o*	-	-	137	30	
p on *o*	-	-	151	30	
p on *a*	-	-	118	30	
o on *a*	-	-	90	00	
p on P	-	-	154	7	
h on *h*	-	-	128	20	
h on *a*	-	-	118	56	
h on *o*	-	-	151	17	
P on *h*	-	-	154	2	

Cleavage parallel with *a* perfect: but sometimes interrupted by conchoidal fracture. The faces obtained in the direction of P are commonly the result of composition. The faces of cleavage and regnlar composition are striated parallel to their common edges of intersection. Fracture conchoidal to uneven. Surface *a* striated parallel to the edges of combination with P. The isosceles pyramids are often deeply striated in a horizontal direction.

Lustre vitreous, much-inclining in some varieties to pearly upon *a*. Color, blue, red, green, yellow, brown, grey and white. Some of the blue, red and yellow colors, very lively and beautiful. Streak white. Transparent . . . trans-

lucent. In several varieties, if cut round, a six-sided opalescent star is observable in the direction of the axis.

Hardness = 9·0.

Sp. gr. = 3·979, blue, transparent (Sapphire.)
3·949, green, translucent (Corundum.)
3·921, brown, faintly translucent (Adamantine-Spar.)
3·909, red, transparent (Ruby.)

Compound Varieties. Regular composition parallel to one or more faces of P, repeated in parallel layers, very frequent. Massive: composition granular, often impalpable, and then the fracture becomes splintery and uneven.

1. Most of the transparent simple varieties have been designated *Sapphire*, while the compound ones have been called *Emery*. The varieties of Sapphire, generally possess an indistinct cleavage, and a conchoidal fracture; the surface of its crystals is smooth, though not always even. The remaining varieties differ almost only in color,—*Corundum*, comprehending those whose color is green, blue or red, and in most cases inclining to grey, while those of *Adamantine-Spar* are hair-brown and reddish-brown. Both of them are easily cleavable, or at least show faces of composition parallel to the primary form; and the crystals possess a rough and uneven surface. There are many crystals, part of which is Sapphire and part Adamantine-Spar.

Before the blow-pipe it is infusible, whether alone or with soda; it is with difficulty soluble in borax, and if previously reduced to powder, also, in salt of phosphorus. It is not acted upon by acids.

2. *Analysis.*

	By Klaproth.		By Tennant.
	Sapphire.	Corundum.	Emery.
Alumina	98·50	89·50	86·00
Silica	0·00	5·50	3·00
Oxide of iron	1·00	1·25	4·00
Lime	0·50	0·00	0·00

3. Corundum is found in imbedded crystals, and in massive varieties. Sapphire is chiefly met with in the sands of rivers, and is accompanied

by crystals and grains of Magnetic Iron-Ore, and several species of gems. The variety Corundum occurs in imbedded crystals in a rock, which consists, according to BOURNON, of Feldspar and Fibrolite, several species of gems and Magnetic Iron-Ore. Adamantine-Spar occurs with Magnetic Iron-Ore and Fibrolite (Kyanite) in a sort of granite, containing no Quartz. Some varieties have been found imbedded in compact Feldspar, Magnetic Iron-Ore, Calcareous-Spar and talcose-slate.

4. The finest varieties of Sapphire come from Pegu, where they occur in the Capelan mountains near Syrian. It has also been found at Hohenstein in Saxony, at Bilin in Bohemia, at Puy in France, and in several other countries. Corundum occurs in the Carnatic in the East Indies; Adamantine-Spar in the neighborhood of Canton in China, and on the coast of Malabar. In St. Gothard, red and blue varieties exist imbedded in dolomite. Those from Gellivara in Sweden, imbedded in Magnetic Iron-Ore, are of a yellowish-white color. Emery is found in the higher part of Saxony, in the mountain called Ochsenkopf near Schneeberg, and is of a dark blue color, inclining to grey; it approaches to the appearance of blue Corundum, whenever its individuals are of considerable size. In the island of Naxos, and in several other islands of the Greek Archipelago, also at Smyrna, Emery is found in large boulders on the surface of the earth, mixed with other minerals.

Very beautiful blue Corundum is found at Newton, (N.J.) disseminated through an aggregate of brown Hornblende, Mica, Feldspar, Tourmaline, Iron Pyrites, Talc and Calcareous-Spar, the whole of which is connected with an extensive bed of white limestone. The majority of the specimens are found in detached boulders of various sizes, distributed through the soil in a kind of basin, or valley of moderate extent, between two small limestone ridges. The crystals of Corundum are often several inches in length, though deficient in perfection of form. They are also found loose in the soil. Very well defined crystals of Corundum of a bluish, and also of a pink color, are found under somewhat similar circumstances in the vicinity of Warwick, (N.Y.) where they sometimes occur in cavities of large crystals of Spinel. Pale blue crystals of this species occur in Connecticut at West Farms, near Litchfield, associated with Kyanite; and single crystals have been found loose in the soil in the State of North Carolina.

5. The pure and transparent varieties of Corundum, when finely colored, are in great estimation as ornamental stones. The red varieties are most highly valued; and go by the name of *Oriental Ruby*. The violet-blue are called *Oriental Amethyst*, the green *Oriental Emerald*,

the yellow *Oriental Topaz*, and the blue *Oriental Sapphire*. *Asteria* is a variety of Sapphire, not perfectly transparent, and shewing a star-like opalescence in the direction of the axis, if cut in oval. Much use is made of Corundum and Adamantine-Spar, particularly in India and China, for cutting and polishing steel and gems, and it is said even of Diamond, which has given occasion to the name of Adamantine-Spar. Emery yields a well known polishing material.

Cottunite.

In acicular crystals.

Lustre adamantine, shining.

Color white.

1. Before the blow-pipe, on charcoal, it melts very easily, coloring the flame blue, and affords a white smoke, which adheres to the coal, turns into greenish yellow flakes, and is chiefly converted into metallic lead. Heated in a matrass, it melts and sublimes. It dissolves in water; and the nitrate of silver throws down from the solution, a precipitate of chloride of silver.

2. *Analysis.*

Chlorine	25·48
Lead	74·52

3. Its locality is believed to be Mount Vesuvius.

4. Additional information is requisite before we can pronounce with confidence as to its specific rank.

Couzeranite.

Primary form. Oblique rhombic prism. M on M = 96°. P on M = 92 or 93°.

Cleavage parallel with the shorter diagonal.

Lustre vitreous. Color greyish black, black and indigo-blue.

Hardness = 7·0. Sp. gr. = 2·6 . . . 2·7.

1. Heated before the blow-pipe, it fuses into a white enamel.

2. *Analysis.*

By Dufrenoy.

Silica	52·37
Alumina	24·02
Lime	11·85
Magnesia	2·40
Potash	5·52
Soda	3·96

3. It is found in many places in the Pyrenees, but chiefly comes from the valley of Vicdessos, passage of Aulus, at the bridge of the Taule, &c.

4. Further investigation is necessary to establish it as a distinct species. It resembles Feldspar.

CRICHTONITE. Axotomous Iron-Ore. MOHS.

Primary form. Rhomboid. P on P = 85° 59′.

Secondary forms.

Fig. 152.

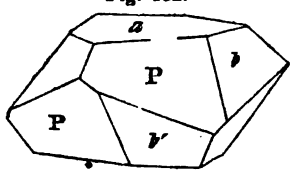


Fig. 153.

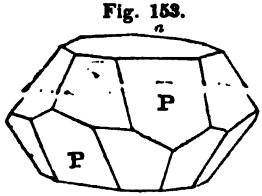
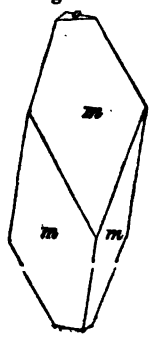


Fig. 154.



P on P	-	-	-	85°	59′
P on *a*	-	-	-	127	40
P on *b*	-	-	-	128	1
P on *b′*	-	-	-	122	28
m on *m*	-	-	-	61	20
m on *o*	-	-	-	97	12

Irregular forms and grains.

Cleavage, perfect parallel to *a*, less distinct parallel with P; and not always observable. Fracture conchoidal. Surfaces generally more rough than smooth, and nearly all of them alike.

Crichtonite.

Lustre imperfectly metallic. Color dark iron-black. Streak black. Opake.

Brittle. Hardness $=5{\cdot}0 \ldots 5{\cdot}5$ Sp. gr. $= 4{\cdot}661$.

Compound Varieties. Twin-crystals: axis of revolution perpendicular, face of composition parallel to *a*: angle of revolution $= 60°$. (See fig. 129.)

The compositions of this kind hitherto observed are not quite regularly formed, but consist generally of several alternating laminæ. The situation of the individuals is, however, recognizable from the direction of their faces.

1. The foregoing description is principally derived from the species *Axotomous Iron-Ore* of MOHS, under which it is believed that the *Crichtonite* falls; and within the present species also must be included the *Ilmenite* of Prof. KUPFER, who describes it as occurring in variously modified oblique four-sided prisms, and as having a black color, brownish streak, shining lustre and a conchoidal fracture; without cleavage, fragments sharp-edged and opake. Hardness $= 4$. Sp. gr. $= 4{\cdot}75$.

2. Alone before the blow-pipe, it does not suffer any alteration whatsoever. With the fluxes it acts in general like pure oxide of iron; but when dissolved in salt of phosphorus and the glass is reduced, there appears as the color of the oxide of iron vanishes, a more or less distinctly red color, the depths of the color depending upon the relative quantity of the titanium in the variety employed.

3. *Analysis.*

Variety *Ilmenite.*

Titanic acid . . .	46·67
Oxide of iron . . .	47·08
Oxide of manganese . . .	2·39
Magnesia . . .	0·60
Lime . . .	0·25
Oxide of chrome . . .	0·38
Silica . . .	2·80

4. It occurs in imbedded grains and crystals, in several varieties of Mica and dolomite, in the valley of Gastein in Salzburg, and frequently along with the crystals of Rutile, over which it often forms a black coating, as at Kluttau in Bohemia, in the gold streams of Ohlapian in

Transylvania, &c. The only locality of the *Crichtonite* variety is the department of the Isère in France, where it occurs in narrow veins along with Anatase.

The variety Ilmenite is found in the Ilmen mountains in the Urals.

The black metallic crystals found accompanying the Spinel, Brucite, Rutile, &c., imbedded in Serpentine and white limestone at Amity, (N.Y.) belong to the present species. They have the form denominated *Fer oligiste imitatif* by HAUY. They are distinguished from Specular Iron by color, fracture, streak, and a diminished specific gravity. It also occurs in broad laminated, imperfectly hexagonal masses, at Washington, (Conn.) imbedded in a vein of Quartz, traversing primitive rocks, and likewise in the eastern part of the same state.

5. The Crichtonite presents us in its crystallization a nearer approximation to perfect isomorphism with Specular Iron, than exists between any other two species where the composition is equally diverse.

CRONSTEDITE. Rhombohedral Iron-Mica.

Primary form. Rhomboid, of unknown dimensions.

Secondary form. Hexagonal prism.

Cleavage, parallel with terminal planes of the hexagonal prism perfect; with the lateral, imperfect.

Lustre vitreous. Color brownish-black. Streak dark leek-green. Opake.

Thin laminæ are elastic. Hardness =2·5 nearly. Sp. gr. = 3·348.

Compound Varieties. Reniform and massive: composition columnar.

1. Before the blow-pipe, it froths a little without melting: with borax, it yields a black, opake and hard bead. Reduced to powder, it gelatinizes in concentrated muriatic acid.

2. *Analysis.*

By STEINMANN.

Silica	22·452
Oxide of iron	58.853
Oxide of manganese	2·885
Magnesia	5·078
Water	10·700

Cryolite.

3. It occurs at Przibram in Bohemia, in veins containing silver-ores, along with Brown Iron-Ore, Spathic Iron, White Iron-Pyrites and Calcareous Spar. It has also been found at Wheal Maudlin in Cornwall.

CRYOLITE. Prismatic Cryone-Haloide. MOHS.

Primary form. Right-rectangular prism. °C.

Cleavage, parallel with P perfect, with M and T less perfect, or coherent. Fracture imperfect or conchoidal, uneven.

Lustre vitreous, a little inclining to pearly upon the faces of P. Color white, sometimes verging upon red or yellowish-brown. Streak white. Semi-transparent . . . translucent. On account of its low refractive power, it appears more transparent when immersed in water.

Brittle. Hardness = 2·5 . . . 3·0. Sp. gr. = 2·963 of a white variety.

Compound Varieties. Massive: composition granular, the individuals being of considerable size.

1. It is very fusible, and melts even in the flame of a candle. Before the flame of the blow-pipe, it is first perfectly liquified; but soon becomes hard again, and assumes at last a slaggy appearance. It is insoluble in water, though it suffers cleavage more readily after having been immersed in it for some time.

2. *Analysis.*

	By KLAPROTH.	By VAUQUELIN.
Alumina	21·0	24·0
Soda	32·0	36·0
Fluoric acid and water	47·0	40·0

3. It occurs at Arksut-fiord, (West Greenland,) in two small layers in gneiss, one of which contains only the white varieties, whereas the other contains the colored ones, accompanied by Galena, Iron-Pyrites, Spathic Iron and Feldspar.

CUBE-ORE. Hexahedral Malachite-Haloide.

Primary form. Cube.

Secondary forms.

1. The cube with the alternate solid angles replaced by triangular planes.

2. The same, but replaced by four planes, three of which rest upon the primary edges, the fourth upon the apex of the new planes.

3. The cube with its edges and angles truncated.

Cleavage, parallel with the primary form difficult and imperfect. Fracture conchoidal, uneven. Surface of the cube sometimes streaked parallel to the edges of the secondary faces situated upon the solid angles. The other faces, with the exception of the secondary planes situated upon the edges of the cube, often curved.

Lustre adamantine, not very distinct. Color olive-green, passing into yellowish-brown, bordering sometimes upon hyacinth-red and blackish-brown; also into grass green and emerald green. Streak, olive-green ... brown, commonly pale. Translucent on the edges.

Rather sectile. Hardness = 2·5. Sp. gr. = 3·000.

Compound Varieties. Massive: composition granular, rare.

1. Exposed to a gentle heat, its color is changed into red. In a higher degree of temperature, it intumesces, gives little, or no arsenic, and leaves a red powder. Upon charcoal, it emits copious fumes of arsenic, and melts in the inner flame into a metallic scoria, which acts upon the magnetic needle.

2. *Analysis.*

	By Chenevix.	By Vauquelin.
Oxide of iron	45·50	48·00
Arsenic	31·00	18·00
Oxide of copper	9·00	0·00
Silica	4·00	0·00
Carbonate of lime	0 00	2·00
Water	10·50	32·00

3. Cube-Ore is chiefly found in veins of copper ores in the older classes of rocks, where it is accompanied by Vitreous Copper, Fahlerz, White Iron-Pyrites and Quartz.

4. It is principally found in Cornwall, in several copper-mines, in the neighborhood of Redruth, but has also been found at St. Leonhard in France, and at Schwarzenberg in Saxony.

In the United States, it has been met with in drusy coatings, along with Mispickel, Iron, and Copper Pyrites, at Edenville in Orange county, (N.Y.) where these minerals exist in gneiss; and under similar circumstances in Derby, (Conn.)

CUMMINGTONITE. Hemi-prismatic Wavellite-Spar?

Massive: composition thin columnar, scopiform and stellular, rather incoherent; fibres somewhat curved.

Cleavage parallel to an oblique rhombic prism.

Lustre silky, color ash-grey. Translucent to opake.

Brittle. Hardness $=6\cdot5$. Sp. gr. $=3\cdot2014$.

1. Alone before the blow-pipe, it is infusible, except on very thin edges. With carbonate of soda it fuses with effervescence into a dark glass. With borax it fuses into a black glass.

2. *Analysis.*

By Muir.

Silica - - - -	56·543
Protoxide of iron - - -	21.669
Protoxide of manganese - -	7·802
Soda - - - -	8·439
Volatile matter - - - -	3·178

3. Cummingtonite is found at Plainfield and Cummington, (Mass.) in mica-slate, associated with Garnet and White Iron-Pyrites.

CUPREOUS ANGLESITE. Cupreous Lead-Baryte.

Primary form. Right oblique-angled prism. M on T $=102^{\circ}\ 45'$.

Cupreous Anglesite—Cupreous Bismuth.

Secondary form.

M on T	- - -	102°	45′	Brooke.	Fig. 155.
P on *f*1	- - -	90	00		
T on *f*1	- - -	161	30		
M on *d*	- - -	120	30		

Cleavage, parallel to M and T very perfect. Surface generally smooth and shining, some of the faces rough.

Lustre, adamantine.

Color deep and beautiful, azure-blue. Streak, pale blue. Faintly translucent.

Rather brittle. Hardness =2·5 . . . 3·0. Sp. gr. =5·30 . . . 5·43. Brooke.

1. *Analysis.*

By Brooke.

Sulphate of lead	- - -	74·4
Oxide of copper	- - -	18·0
Water	- - -	4·7

2. It is found along with other ores of lead, at Lead Hills in Scotland: also at Linares in Spain.

CUPREOUS BISMUTH. Prismatoidal Polypoione-Glance.

Crystalline. Primary form not known; probably prismatic. Massive: composition columnar, the individuals being long and slender; also impalpable.

Cleavage, in one direction parallel with the prismatic axis. Fracture uneven, or imperfectly conchoidal.

Lustre metallic. Color steel-grey, light copper-red, passing to yellowish. Streak blackish grey.

Hardness =2·0 . . . 2·5. Sp. gr. =6·125.

1. It melts very easily before the blow-pipe, coloring the flame of the lamp, blue; and leaving, after the fumes have subsided, a whitish, or sul-

phur, yellow slag, which, on being heated with soda, yields metallic copper. The powder is dissolved in nitric acid, with evolution of red fumes, and the precipitation of sulphur and sulphate of lead. The solution affords with water a white precipitate of oxide of bismuth, or with sulphuric acid, one of sulphate of lead.

2. *Analysis.*

	By JOHN, from Ecatherineburg.	By KLAPROTH, from Baden.
Sulphur	11·58	16·3
Bismuth	43·20	27·0
Lead	24·32	33·0
Copper	12·10	0·9
Nickel	1·58	0·0
Tellurium	1·32	0·0
Silver	0·00	15·0
Iron	0·00	4·3

3. It is found in the mines of Pyschminskoi and Klutschefskoi in the district of Ecatherineburg in Siberia, in Quartz, accompanied by Native Gold and Galena. The variety analyzed by KLAPROTH occurs in Quartz and Fluor, with Iron Pyrites, Copper Pyrites and Galena, at Schapbach in Baden.

APPENDIX TO CUPREOUS BISMUTH.

i. *Cupreous Sulphuret of Bismuth.*

Crystalline in fibrous masses and capillary crystals.

Lustre metallic. Color light steel-grey to tin-white. Streak white.

1. *Analysis.*

By KLAPROTH.

Sulphur	12·58
Bismuth	47·24
Copper	34.66

2. It occurs at Gallenbach in the principality of Fürstenberg, in a disintegrated granite with Heavy Spar, Native Bismuth and Copper Pyrites.

CUPREOUS MANGANESE. Staphyline Manganese-Ore.

Small reniform and botryoidal groupes, massive. Composition impalpable. Fracture imperfectly conchoidal.

Cupreous Manganese—Datholite.

Lustre resinous. Color bluish-black. Streak unchanged. Opake.

Hardness = 3·5. Sp. gr. = 3.197 . . . 3·216.

1. Before the blow-pipe, it becomes brown, but is infusible. To borax and salt of phosphorus, it communicates the colors of copper and manganese. 2. *Analysis.*

By LAMPADIUS.

Black oxide of manganese . .	82·00
Brown oxide of copper . .	13·50
Silica . .	2·00

BERZELIUS found it to contain a considerable quantity of water.

3. It occurs in the tin mines at Schlaggenwald in Bohemia, and at Armarilla in Chili.

CYANITE. (See *Kyanite.*)

CYMOPHANE. (See *Chrysoberyl.*)

CYPRIN. (See *Idocrase.*)

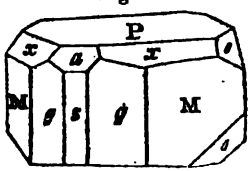
DAVYNE. (See *Nephiline.*)

DATHOLITE. Prismatic Dystome-Spar. MOHS.

Primary form. Right rhombic prism. M on M′ = 102° 30′.

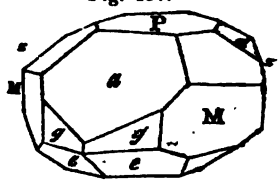
Secondary forms.

Fig. 156.



Arendal.

Fig. 157.



Seiseralp.

M on M	-	= 77°	30′	x on x	-	122°	00′
g on g	-	116	9	x on d	-	115	45
P on s	-	90	00	x on o	-	177	04
P on a	-	136	04				

Datholite.

Cleavage, very indistinct parallel to *s*, but somewhat more easily observed parallel to P. Fracture uneven, imperfectly conchoidal. Surfaces, several faces much streaked, and others altogether rough.

Lustre vitreous, and particularly in the fracture inclining to resinous. Color white, inclining to green, yellow, and grey; sometimes of a dirty olive green, or honey-yellow tinge. Streak white, more or less translucent.

Brittle. Hardness = 5·0 . . . 5·5. Sp. gr. = 2·989, a variety from Arendal.

Compound Varieties. Botryoidal and implanted globular shapes, surface drusy, composition columnar. Massive: composition columnar, consisting of delicate, straight and generally diverging individuals, radiating from a centre; also granular, of various sizes of individuals, faces of composition rough and irregularly streaked.

1. Owing to the variation of position in which the crystals of this species were at first described, they were referred to two different species, *Datholite* and *Humboldtite*, the latter of which is now abandoned. Still another species or sub-species, according to some authors, the *Botryolite*, requires also to be united with Datholite. It embraces the reniform and globular shapes, consisting of thin individuals; but specimens have lately been discovered, which clearly prove, by transition, their connexion with Datholite.

Exposed to the flame of a candle, it becomes friable; before the blowpipe, it loses its transparency, intumesces, and melts into a glassy globule. It is easily soluble in nitric acid, and leaves a siliceous jelly.

2. *Analysis.*

By Klaproth.

	of *crystals.*	of *Botryolite.*
Silica	36·50	36·00
Lime	35 50	39 50
Boracic acid	24·00	18·50
Oxide of iron	0·00	1·00
Water	4·00	6·50

3. It occurs in beds of iron-ore, in primitive rocks, accompanied by Calcareous Spar; sometimes also by Fluor, Hornblende, Quartz and Prehnite: with the latter species, and several others of the Zeolite family, it is found in agate balls and irregular veins in trap-rocks.

4. Upon the beds of iron-ore at Arendal in Norway, are found the varieties of Datholite and Botryolite. The Humboldtite occurs in agate balls in the Seiseralp in the Tyrol, and in irregular veins in greenstone in Salisbury-craig near Edinburgh.

In the United States, in New Jersey at Paterson, the Datholite has been met with in large and well defined forms, in trap; and at Middlefield in Connecticut, the variety Humboldtite occurs under similar circumstances, and in cavities; also on Mt. Carmel, at Hamden, (Conn.) with Prehnite.

DERMATIN. (See *Kerolite.*)

DEWEYLITE. (See *Kerolite.*)

DIALLOGITE. Macrotypous Parachrose-Baryte. MOHS.

Primary form, a rhomboid. P on P=106° 51′.

Secondary form, the primary having the upper edges replaced by tangent planes.

Cleavage, parallel to the primary form. Fracture uneven, imperfectly conchoidal. Surface streaked parallel with the edges of the new planes, thus producing lenticular crystals.

Lustre vitreous, inclining to pearly. Color various shades of rose-red, partly inclining to brown. Streak white. Translucent in different degrees.

Brittle. Hardness =3·5. Sp. gr. =3·592 of the crystallized variety from Kapnik.

Compound Varieties. Globular and botryoidal shapes: surface sometimes smooth, at other times rough; composition columnar, often indistinct. Massive: composition granular, sometimes small, and even impalpable; sometimes it is columnar.

Diallogite.

1. The varieties of the present species have often been confounded with other minerals, one of which has been proposed by BREITHAUPT as a distinct species, an account of which will be given at the close of this description.

Before the blow-pipe, its color is changed into grey, brown and black, and it decrepitates strongly; but is infusible without addition. It is easily fusible in glass of borax, which thereby becomes of a violet blue color. If exposed to the air, its natural color is changed into brown. Many bright rose-red varieties become paler on being exposed in a similar manner. It effervesces briskly in nitric acid.

2. *Analysis.*

	By DUMENIL.	By BERTHIER, fr. Nagyag.
Oxide of manganese	54·60	56·00
Carbonic acid	33·75	38·60
Oxide of iron	1·87	0·00
Silica	4·37	0·00
Lime	2·50	5·40

3. It occurs for the most part in metalliferous veins, with various ores of Iron and Copper, and with Quartz. It is also found in beds with other minerals containing manganese.

4. It is found in several of the Saxon mines, particularly in the neighborhood of Freiberg; also at Nagyag and Kapnik in Transylvania, near Elbingerode in the Hartz, and in other countries.

i. *Manganeseous Carbon-Spar.* BREITHAUPT.

P on P = 107° 30′.

Cleavage parallel to the primary, easily effected.

Hardness (scale of BREITHAUPT) = 5·75 . . . 6·0. Sp. gr. = 3·592.

BREITHAUPT includes in this species the mineral from Kapnik only. This variety was analyzed by BERTHIER, and found to contain,

Carbonic acid	30·4
Protoxide of manganese	41·0
Lime	4·3
Quartz	21·0
	96·7

DIAMOND. Octahedral Diamond. MOHS.

Primary form. Regular octahedron.

Secondary forms.

1. Primary form, having its solid angles replaced by tangent planes.

2. Primary form, having its edges replaced by tangent planes.

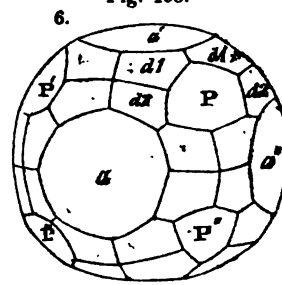
3. Cube.

4. Cube, having its edges replaced by tangent planes.

5. Rhombic dodecahedron.

Fig. 158.

6.



The annexed figure represents in planes P P′ P″ and P‴ the primary faces of the octahedron, and in *a a′ a″* those of the cube, which are generally flat and brilliant. The numerous faces *d*1 and *d*2, are uniformly convex; each of which is, in reality, a series of planes, as is manifest on other crystals, but in no instance sufficiently perfect for the use of the reflective goniometer.

Irregular forms and grains.

Cleavage, parallel with the primary octahedron, perfect. Fracture, conchoidal. Surface, the octahedron sometimes faintly streaked parallel to its edges of combination, but in general very smooth. Also the dodecahedron, if often streaked, rough and uneven; the tetraconta-octahedron, curved and smooth. Grains possess a rough and granulated surface.

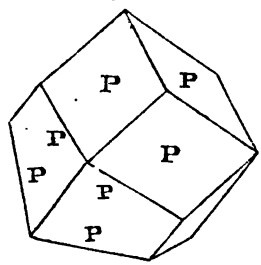
Lustre bright adamantine. Color white, prevalent; also various shades of blue, red, yellow, green, brown, grey,

and even black. Generally pale. Streak white. Transparent... translucent, dark colored varieties only on their edges. If cut and polished, it shows a most lively play of color.

Hardness =10·0. Sp. gr.=3·520, of a white variety.

Compound Varieties. Twin-crystals. Axis of revolution perpendicular to a face of the octahedron; angle of revolution =60°. (See fig. 50.) Also, axis of revolution parallel to one of the axes of the rhombic dodecahedron which passes through the obtuse solid angles. (See the annexed figure.) Angle of revolution =60°.

Fig. 159.



1. Diamond is perfectly combustible at a temperature of about 14° Wedgewood, and yields with oxygen, carbonic acid gas. It is not acted upon by acids or alkalies.

2. The rocks hitherto considered as the gangue of Diamond are secondary ones, as several kinds of sandstone, consisting of aggregated quartz pebbles. It is also found in strata of iron-shot sand and clay, and in the loose sand of plains and rivers. In a specimen from Brazil, in the possession of Mr. HEULAND, it is associated with Skorodite, and imbedded in a compact variety of Brown Iron-Ore.

3. The Diamond was first discovered in the East Indies, where it has been worked for many centuries, and in Brazil. They are found in various places on the eastern coast of the British peninsula in India, but particularly between Golconda and Masulipatam; also near Panna in Bundelcund. It also occurs in the peninsula of Malacca, and the isle of

Borneo. In Brazil, they occur in the district of Serro do Frio in the capitania of Minas Geraes, and were first discovered in the Riacho Fundo, then in the Rio do Peixe, and also in the Terra de St. Antonio.

4. Diamond is the most valuable of all the gems. It is employed also in cutting glass, and for engraving, cutting and polishing other hard stones, and the Diamond itself.

DIASPORE. Tetarto-prismatic Wavelline-Spar?

Primary form. Doubly oblique prism, according to PHILLIPS. M on T=64° 54′. P on T=101° 20′. P on M=108° 30′. According to MOHS, it is a rhombic prism of about 130°.

Lustre vitreous and pearly. Color greenish-grey.

Translucent on the edges.

Scratches glass. Sp. gr.=3·4324.

1. Before the blow-pipe, it decrepitates most violently, and splits into many small scaly particles, possessing a feeble alkaline reaction.

2. *Analysis.*

	By VAUQUELIN.	By CHILDREN.
Alumina	80·00	76·06
Protoxide of iron	3·00	7·78
Water	17·30	14·70

BERZELIUS is of opinion that besides these, it also contains some alkaline substance.

3. Its locality is unknown.

4. Its reference to the genus Wavelline-Spar is made with hesitation, from the limited knowledge possessed of its properties. Unless some clue to the discovery of its locality shall ere long be made, it will become doubtful whether it is not an artificial production.

DICHROITE. (See *Iolite.*)

DIOPSIDE. (See *Pyroxene.*)

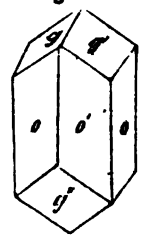
DIOPTASE. Rhombohedral Copper-Baryte.

Primary form. Rhomboid. P on P=126° 17′.

Dioptase.

Secondary form.

Fig. 160.



g on *g'*	-	-	95°	33′
o' on *o* or *o*	-	-	120	04
g on *o*, or *g'* on *o'*		-	173	00

Cleavage, parallel with the primary form, perfect. Fracture conchoidal, uneven.

Lustre vitreous, inclining to resinous. Color emerald green, also blackish-green, and verdigris-green. Streak green. Transparent . . . translucent.

Brittle. Hardness = 5.0. Sp. gr. = 3·278.

1. It decrepitates before the blow-pipe, and upon charcoal it becomes black in the exterior flame, and red in the interior one, without melting. It is easily soluble in glass of borax, and imparts to it a green color. It is soluble without effervescence in muriatic acid.

2. *Analysis.*

	By Lowitz.	By Vauquelin.
Oxide of copper	55·00	25·57
Carbonate of lime	0·00	42·85
Silica	33·00	28·57
Water	12·00	0·00

3. It has been found accompanied by Green Malachite and Calcareous Spar, but the nature of its original repositories is not known. It occurs in the Kirghese steppes in Siberia. Minute crystals are said to accompany the Electric Calamine of Rezbanya in Hungary.

Diploite. (See *Latrobite.*)

Dipyre. (See *Scapolite.*)

CUBE-ORE. Hexahedral Malachite-Haloide.

Primary form. Cube.

Secondary forms.

1. The cube with the alternate solid angles replaced by triangular planes.

2. The same, but replaced by four planes, three of which rest upon the primary edges, the fourth upon the apex of the new planes.

3. The cube with its edges and angles truncated.

Cleavage, parallel with the primary form difficult and imperfect. Fracture conchoidal, uneven. Surface of the cube sometimes streaked parallel to the edges of the secondary faces situated upon the solid angles. The other faces, with the exception of the secondary planes situated upon the edges of the cube, often curved.

Lustre adamantine, not very distinct. Color olive-green, passing into yellowish-brown, bordering sometimes upon hyacinth-red and blackish-brown; also into grass green and emerald green. Streak, olive-green ... brown, commonly pale. Translucent on the edges.

Rather sectile. Hardness = 2·5. Sp. gr. = 3·000.

Compound Varieties. Massive: composition granular, rare.

1. Exposed to a gentle heat, its color is changed into red. In a higher degree of temperature, it intumesces, gives little, or no arsenic, and leaves a red powder. Upon charcoal, it emits copious fumes of arsenic, and melts in the inner flame into a metallic scoria, which acts upon the magnetic needle.

2. *Analysis.*

	By Chenevix.	By Vauquelin.
Oxide of iron	45·50	48·00
Arsenic	31·00	18·00
Oxide of copper	9·00	0·00
Silica	4·00	0·00
Carbonate of lime	0 00	2·00
Water	10·50	32·00

3. Cube-Ore is chiefly found in veins of copper ores in the older classes of rocks, where it is accompanied by Vitreous Copper, Fahlerz, White Iron-Pyrites and Quartz.

4. It is principally found in Cornwall, in several copper-mines, in the neighborhood of Redruth, but has also been found at St. Leonhard in France, and at Schwarzenberg in Saxony.

In the United States, it has been met with in drusy coatings, along with Mispickel, Iron, and Copper Pyrites, at Edenville in Orange county, (N.Y.) where these minerals exist in gneiss; and under similar circumstances in Derby, (Conn.)

CUMMINGTONITE. Hemi-prismatic Wavelline-Spar?

Massive: composition thin columnar, scopiform and stellular, rather incoherent; fibres somewhat curved.

Cleavage parallel to an oblique rhombic prism.

Lustre silky, color ash-grey. Translucent to opake.

Brittle. Hardness $=6\cdot5$. Sp. gr. $=3\cdot2014$.

1. Alone before the blow-pipe, it is infusible, except on very thin edges. With carbonate of soda it fuses with effervescence into a dark glass, With borax it fuses into a black glass.

2. *Analysis.*

By Muir.

Silica - - - -	56·543
Protoxide of iron - - -	21.669
Protoxide of manganese - -	7·802
Soda - - - -	8·439
Volatile matter - - - -	3·178

3. Cummingtonite is found at Plainfield and Cummington, (Mass.) in mica-slate, associated with Garnet and White Iron-Pyrites.

CUPREOUS ANGLESITE. Cupreous Lead-Baryte.

Primary form. Right oblique-angled prism. M on T $=102^{\circ}\ 45'$.

eties, provided their faces are not curvilinear or unusually pearly; also to large grained and easily cleavable varieties, chiefly of greenish colors. *Brown-spar* comprehends those varieties which possess a reddish brown color. *Pearl-spar* included crystallized varieties with curved faces, and possessed of a pearly lustre. The massive varieties of granular composition were called *Dolomite*.

Before the blow-pipe, some of the varieties assume a darker color, and a higher degree of hardness. They are soluble in acids, but much more slowly than Calcareous Spar, and attended with less effervescence.

2. It is difficult to judge of the chemical composition of Dolomite. It contains carbonate of lime and carbonate of magnesia; but the relative quantity of the two has not been accurately settled. From several analyses by KLAPROTH, the proportion appears to be nearly as 54·18 : 45·82, which corresponds to

Lime - - - -	30·56
Magnesia - - - -	22·18
Carbonic acid - - - -	47·26

Several analyses of brown-spar give very similar results; others deviate more or less from them. In general, brown-spar seems to contain more oxide of iron and manganese, than either the old varieties dolomite or rhomb-spar.

3. The different varieties of Dolomite differ in respect to their localities. The granular variety (dolomite) constitutes beds in other rocks, and therefore belongs, itself, to the class of rocks. Rhomb-spar occurs in imbedded crystals and compound masses, in several kinds of rocks, particularly in common Talc, and less frequently in compact varieties of gypsum that are mixed with clay. Brown-spar is principally found in metalliferous veins.

4. The variety called Dolomite occurs in St. Gothard, in the Appennines, and in Carinthia; Rhomb-spar in various districts of Salzburg, the Tyrol and Switzerland, at Miemo in Tuscany, (from which the name of *Miemite* has been derived,) and in many other countries; beautiful crystals at Traversella in Piedmont. Brown-spar and Pearl-spar are very frequent at Schemnitz in Hungary, Kapnik in Transylvania, Freiberg and elsewhere in Saxony, at Clausthal in the Hartz, in Norway and Sweden, at Alston Moor in Cumberland, in the greywacke quarries of the same country, in Derbyshire, Baeralston and other places in Devonshire.

Dolomite.

In the U. States the Rhomb-spar variety or bitter-spar, occurs abundantly at numerous places in R. Island, Massachusetts and Vermont, imbedded in common Talc or its variety, steatite; as at Roxbury, (Vt.) where it occurs in large, yellow, transparent crystals, imbedded in greenish transparent Talc; at Smithfield, (R. I.) where it occurs in large grained, easily cleavable individuals, associated with white Talc in Calcareous Spar or limestone, and rarely in very perfect implanted rhomboids of small dimensions. The Pearl-spar exists abundantly both of a white color, and with a delicate pink tinge, at Lockport, (N.Y.) where it is associated with Calcareous Spar, Celestine, and Gypsum in geodes, occurring in transition limestone. The brown-spar is found at numerous places in New York and Ohio, where it occurs in greywackes and secondary limestones, in the form of veins and seams. The massive variety of Dolomite constitutes extensive beds in Litchfield county, (Conn.) and in the south western towns of Massachusetts.

5. Dolomite is often employed as a marble, and rarely in the production of quick lime.

Appendix to Dolomite.

i. *Eumetric Carbon-Spar.* Breithaupt.

P on P = 106° 11′.
Cleavage parallel with P uncommonly perfect and easy.
Hardness = 5·0, (scale of Breithaupt.)
Sp. gr. = 2·9177, a cleavage crystal.

The Eumetric Carbon-Spar embraces only the beautiful twin-crystals, above alluded to, from Traversella in Piedmont.

ii. *Tautoklinous Carbon-Spar.* Breithaupt.

P on P = 106° 10′ 40″.
Cleavage parallel with P perfect.
Hardness = 4·75 . . . 5. (scale of Breithaupt.)
Sp. gr. = 2·9633. } Fragments of cleavage crystals from the
2·9644. } mine of Beschert Glück in Freiberg.
Color reddish, or greyish-white.

It occurs at Freiberg, Johann-Georgenstadt, and probably the brown-spar of Schneeberg belongs to the present species.

iii. *Kryptose Carbon-Spar.* Breithaupt.

P on P = 106° 19′.
Cleavage parallel with P, but not very perfect.

Hardness = 4·50 . . . 4·75. (scale of BREITHAUPT.)
Sp. gr. = 2·809, reddish-white, cleavage crystal.
2·810, brownish red, cleavage crystal.
2·827, dark brownish red and brown, with delicate black stripes; both from Freiberg.

1. It consists, according to KARSTEN, of

Carbonate of lime - - - -	96·40
Carbonate of protoxide of manganese - -	2·10
Carbonate of iron - - - -	0·95
Water and loss - - - -	0·55

It is found only at two mines in Freiberg.

iv. *Isometric Carbon-Spar.* BREITHAUPT.

P on P = 106° 19′.
Cleavage parallel with P perfect.
Hardness = 5·50 . . . 5·75. (scale of BREITHAUPT.)
Sp. gr. = 2·847, minute, ash-grey crystals in gypsum, from Hall in Tyrol.
2·849, greenish white masses of a compound variety, from Koloseruck in Bilin, (Bohemia,) where it occurs in seams in basalt.
2·853, minute, but possibly not perfectly pure cleavage crystals, of the above variety, from Hall.
2·857, minute, pure, and white cleavage crystals, from Dinz.
2·859, asparagus green, cleavage crystals, from Schweinsdorf. (Tharaudite.)

The variety from Hall afforded, to KLAPROTH,

Carbonate of lime - - - -	68·0
Carbonate of magnesia - - - -	25·5
Carbonate of protoxide of iron - - - -	1·0
Water - - - -	2·0
Foreign matter - - - -	2·0

DYOXYLITE. Prismatoidal Lead-Baryte. HAIDINGER.

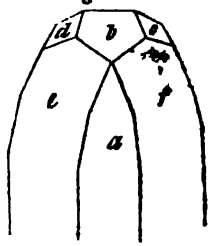
Primary form. Right rhombic prism. M and M′ = 120° 45′.

Dyoxylite.

Secondary form.

a on *b*	-	-	111°	00′	PHILLIPS.
b on *b*	-	-	130	00	
a on *c*	-	-	106	45	
a on *d*	-	-	73	45	
a on *e*	-	-	123	20	
c on *f*	-	-	133	00	
d on *e*	-	-	136	54	

Fig. 163.



Cleavage parallel with M and P, but more perfectly parallel with the shorter diagonal. The laminæ resulting from cleavage are flexible, like Gypsum.

Lustre adamantine, inclining to resinous, pearly upon the perfect face of cleavage. Color greenish-white, or yellowish white, sometimes inclining to grey. Streak white. Translucent.

Sectile. Hardness =2·0...2·5. Sp. gr.=6·8...7·0.

1. *Analysis.*

By Brooke.

Carbonate of lead - - -	46·9
Sulphate of lead - - -	53·1

The effervescence while dissolving in nitric acid is scarcely perceptible.

2. It is found in columnarly aggregated crystals, at the Lead hills in Scotland.

Dysclasite.

Massive; imperfectly fibrous; the fibres sometimes divergent.

Lustre vitreous. Color white. Translucent. It possesses double-refraction.

Tough. Hardness above Fluor. Sp. gr. = 2·362.

1. Heated to redness, it emits moisture. Before the blow-pipe, it fuses only on the edges. With soda it forms a semi-transparent glass, and with borax and salt of phosphorus it gives colorless glasses. It gelatinizes readily with muriatic acid.

Dysluite.

2. *Analysis.*

By CONNELL.

Silica - - - -	57·69
Lime - - - -	26·83
Water - - - -	14·71
Soda - - - -	0·44
Potash - - - -	0·28
Oxide of iron - - - -	0·32
Oxide of manganese - - -	0·22

3. Its locality is Faroe.

DYSKOLITE. (See *Saussurite.*)

DYSLUITE.

Primary form. Regular octahedron.

Secondary form. Regular octahedron, with its edges truncated.

Cleavage parallel with the primary rather imperfect. Fracture sub-conchoidal. Surface rough.

Lustre vitreous, inclining to resinous. Color yellowish-brown or greyish-brown. Streak paler than the color. Translucent on the edges . . . to opake.

Hardness = 7·5 . . . 8·0. Sp. gr. 4·0 . . . 4·6.

1. Before the blow-pipe, it is infusible.

2. It is found in small quantity, at Sterling, (New Jersey,) disseminated through laminated Calcareous Spar, and associated with Franklinite and Troostite.

3. There is nothing but the unimportant property of color to distinguish this mineral from Automalite, to which it should, without doubt, be referred.

DYSODILE.

Massive; compact or laminated. Extremely fragile.

Fracture earthy.

Soft, scratched by the nail. Sp. gr. = 1·1 . . . 1·2.

Color greenish and yellowish, to liver-brown. Streak vitreous. Macerated in water, it becomes translucent, and its laminæ acquire elasticity. When breathed upon, it emits an argillaceous odor.

1. It burns with a considerable flame and smoke, and an almost insupportably fetid odor, leaving a residue of nearly half its weight, and anal-

tered in form. It occurs at Melili, near Syracuse in Sicily, in the form of a bed of inconsiderable thickness, between beds of a secondary limestone.

2. It probably belongs to the species Bitumen, so far as it is a simple mineral.

EARTHY COBALT. Cobaltic Lusine-Ore.

Pulverulent, investing ores of iron and of cobalt, and intermingled with these, and with earthy matters.

Color black.

1. Heated upon charcoal, it gives no arsenical odor; and fused with soda, gives no indication of manganese. With borax, it forms a very intensely blue glass.

2. Beudant suggests its composition to be,

Oxygen - - - -	28·90
Cobalt - - - -	71·10

3. It is probably derived from the decomposition of the arseniurets of cobalt, being found in small quantity with these ores.

4. Its principal localities are Würtemberg, Saalfeld, Joachimsthal and the Tyrol.

5. The *botryoidal* and the *stalactitic Earthy Cobalt*, whose sp. gr. = 2·24, and which afford moisture when heated, and the smell of arsenic, appear to be mixtures of the above mineral with Brown Iron-Ore, some of the ores of cobalt and of manganese, together with accidental earthy ingredients; of which character appear to be the following minerals:

From Riechelsdorf.
Analyzed by Klaproth.

Peroxide of cobalt with oxide of manganese - -	97·0
Oxide of manganese - - - - - -	80·0
Oxide of copper - - - - - -	1·0
Water - - - - - -	85·0
Silica - - - - - -	124·0
Alumina - - - - - -	102·0

From Saalfeld.
Analyzed by Doebereiner.

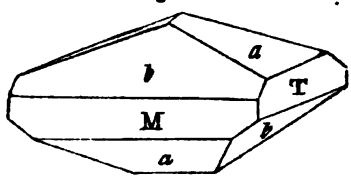
Oxide of cobalt and of manganese - - - -	76·9
Water - - - - - - - -	23·1

EDINGTONITE. Pyramidal Dystome-Spar.

Primary form. Right rectangular prism?

Secondary form.

Fig. 164.



Cleavage, pretty distinct parallel to the primary faces. In other directions a small and conchoidal fracture. Surface, M and T generally smooth, the rest curved and without lustre.

Lustre vitreous. Color greyish white. Semi-transparent, but oftener translucent. Streak white.

Hardness =4·0...4·5. Sp. gr. =2·71.

1. It yields moisture when calcined. It is fusible before the blowpipe into a transparent glass. It gelatinizes in the acids.

2. *Analysis.*

By Turner.

Silica	35·09
Alumina	27·69
Lime	12·68
Water	13·32

3. It occurs at Kilpatrick near Dumbarton, (Scotland,) where it is accompanied by Harmotome and Thomsonite, being implanted upon the latter mineral in crystals, the largest of which is only two lines in diameter.

Ekebergite. (See *Scapolite.*)

Elaolite. (See *Nepheline.*)

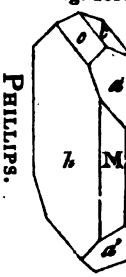
ELECTRIC CALAMINE. Prismatic Zinc-Baryte. MOHS.

Primary form. Right rhombic prism. M on M = 102° 35′.

Secondary form.

Fig. 165.

M on M	-	-	102°	30′	PHILLIPS.
M on *a*	-	-	132	35	
a on *h*	-	-	128	40	
a on *c* or *e*	-	-	115	00	
c on *c′*	-	-	126	36	



Cleavage, parallel with the primary lateral planes, perfect; traces of cleavage parallel with the terminal planes. Fracture uneven. Surface of lateral planes streaked parallel with their common intersections. The rest of the faces generally smooth, sometimes rounded.

Lustre vitreous, inclining to pearly, sometimes to adamantine upon curved faces of crystallization. Color white, prevalent: occasionally blue, green, yellow or brown. Streak white. Transparent . . . translucent.

Brittle. Hardness = 5·0. Sp. gr. = 3·379, crystals from Rossegg in Carinthia.

Compound Varieties. Globular, botryoidal shapes: surface drusy. Massive: composition either granular or columnar; the former of them often impalpable and strongly coherent, and then the fracture becomes uneven; the latter straight and divergent.

Electric Calamine.

1. In some of the crystals of Electric Calamine, dissimilar modifications have been observed upon the opposite extremities of the same crystals, as in Tourmaline; attended also with the evolution of different kinds of electricity, as in that mineral. Like the Tourmaline, the electric excitation is occasioned by common changes of atmospheric temperature; and is not destroyed in the crystals, even after their exposure to a red heat.

Before the blow-pipe, it decrepitates a little, loses its transparency, intumesces, and emits a green phosphorescent light. It is infusible without addition, but is dissolved by borax into a clear glassy globule, which becomes opake on cooling. It is phosphorescent by friction. Reduced to powder, it is soluble in heated sulphuric or muriatic acid, and when cooled, it forms a jelly.

2. *Analysis.*

	By Berthier.	By Berzelius.
Oxide of zinc	66·00	66·37
Silica	25·00	26·23
Water	9·00	7·40

This species has been found artificially produced, lining the throats of iron furnaces, in Salisbury, (Conn.) where the ore employed is the Brown Iron-Ore. The furnaces are constructed of mica-slate. The mineral presents itself in coatings, quarter of an inch in thickness, having botryoidal shapes with drusy surfaces. Its color is a delicate straw-yellow.

3. Electric Calamine is found along with Calamine in veins belonging to various classes of rocks, but chiefly calcareous ones. It is usually associated with Blende and Galena.

4. Considerable quantities occur at Bleiberg and Raibel in Carinthia, Rezbanya in Hungary, Freiburg in Brisgau, Altenberg near Aix-la-Chapelle, near Tarnowitz in Silesia, at Olkuzk and Medziana Gora in Poland and in Siberia. It occurs in Leicestershire, Derbyshire, Flintshire, Somersetshire, &c., in England; at Wanlockhead and Lead-Hills in Scotland.

In the United States, it has of late been discovered in Jefferson co. (Missouri) at a lead mine called Valle's diggings, where it is associated with Calamine.

Emerald. (See *Beryl.*)

Emery. (See *Corundum.*)

Epidote.

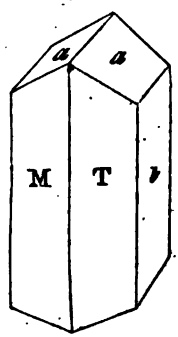
ENDELLIONE. (See *Bournonite.*)

EPIDOTE. Prismatoidal Augite-Spar. MOHS.

Primary form. Right oblique-angled prism. M on T =115° 40′.

Secondary forms.

Fig. 166.



Franconia, (N.H.)

M on T	115°	36′
T on *b*	128	35
b on M′	116	26
a on *a*	109	24
a on *b*	125	32

Fig. 167.

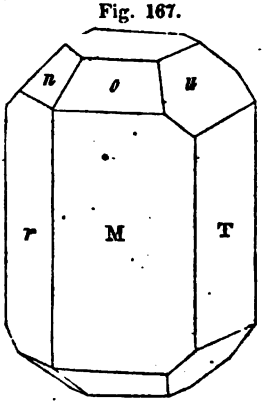
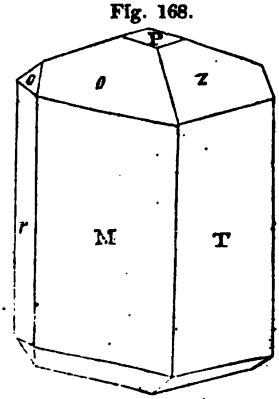


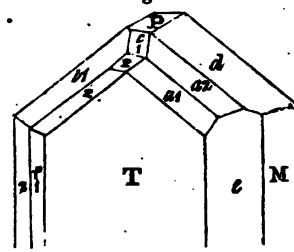
Fig. 168.



M on *o*	121°	23′	HAUY.	P on *o*	148° 37′
M on *r*	116	40		P on *u* (fig. 167)	125 35
T on *u*	144	25		P on *z*	145 3

Epidote.

Fig. 169.



M on *e*	150°	15′	PHILLIPS.	P on *d*	145°	6′
T on *e*	145	24		P on *c*1	148	30
T on *f*1	145	39		T on *c*1	121	50
T on *f*2	114	40		T on *b*1	104	30
M on *d*	125	2		T on *b*2	142	35

Cleavage, perfect parallel to M; less so parallel to T. Fracture, uneven. Surface, the lateral planes sometimes streaked vertically: in general, the faces are smooth.

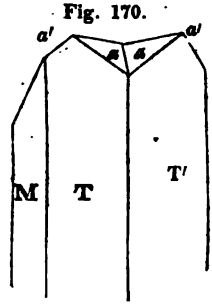
Lustre vitreous, inclining to pearly upon perfect faces of cleavage, and the corresponding faces of crystallization. Color, green and grey, prevalent. Among the most common shades of the first, is pistachio-green; in general, the green tints are more inclined to yellow than in Pyroxene and Hornblende. The grey colors pass into white and a very pale flesh-red. Streak greyish-white. Semi-transparent... translucent on the edges. Viewed in a direction parallel to the axis, the color of the crystals contains less yellow than in the directions perpendicular to it.

Brittle. Hardness =6·0...7·0. Sp. gr. =3·269, variety Zoisite, from the Saualpe; =3·425, Pistazite, from Arendal.

Compound Varieties. Twin-crystals: axis of revolution parallel to the prismatic axis, as represented in the annexed figure; angle of revolution = 180°.

Epidote.

Fig. 170.



Franconia, (N. H.)

M on T	-	115° 36′	*a* on *a'*	-	109° 24′
T on T′	-	129 35			

Several varieties consist of concentric coats, the outer ones of which being pealed off, leave a crystal with smooth faces. Massive: composition granular, of various sizes of individuals, sometimes impalpable, strongly-connected: columnar, straight, and either parallel or divergent, or irregular, and of various sizes of individuals.

1. Epidote includes *Zoisite*, or the grey and whitish colored varieties of the present species, and which by some mineralogists have been treated of, as constituting a separate species. The light reddish-black variety from Piedmont, called the Manganesian Epidote, is Zoisite tinged by oxide of manganese.

2. Before the blow-pipe, the varieties of Epidote intumesce, and partly exfoliate, but are with difficulty brought to the condition of a transparent glass. Those with much iron are more easily fused than the rest. With borax, Epidote first intumesces, and then yields a clear globule.

3. *Analysis.*

	By Klaproth, fr. the Saualpe. *Zoisite.*	By Descotils, fr. Dauphiny. *Epidote.*	By Vauquelin, fr. Norway. *Epidote.*
Silica	45·00	37·00	37·00
Alumina	29·00	27·00	21·00
Lime	21·00	14·00	15·00
Oxide of iron	3·00	17·00	24·00

4. Epidote is found variously disseminated in nearly all the primitive rocks, without however entering into their composition as a regular ingredient, but rather occurring in single, drusy cavities, narrow seams and veins. The finer crystallizations belong to beds of Magnetic Iron-Ore. The variety Zoisite occurs in single crystals and crystalline masses in beds, with Hornblende, Kyanite, Garnet and Zircon.

5. Magnificent crystals of Epidote are found in the iron-mines of Arendal, Norway. Similar varieties occur also in Sweden. Very handsome crystallizations of the present species are found in Switzerland, Piedmont, the Pyrenees and the Upper Palatinate. Less remarkable varieties come from the Saualpe, where the transition of the green colored crystals into the grey, or Zoisite, is observed. The grey colored Epidote, or Zoisite, is found in the Bache mountain and Schwamberg Alpe in Lower Stiria; in the Fichtelgebürge, and in the Tyrol. The red manganesian varieties occur at St. Marcel in the valley of Aosta in Piedmont.

Crystals, resembling in size, color and form, those from Norway and Sweden, occur in the iron-mine of Franconia and in its vicinity, in the state of New Hampshire. Very beautiful grey crystals, though of small diameter compared with their length, have been found at Hawley, penetrating small beds of quartz in hornblende-rock. The pistachio-green crystals occur at Cumberland, (R. I.) in veins and drusy cavities, in a species of trap-rock. A variety precisely similar to that from Piedmont has been found in small quantity at Haddam, (Con.) forming a vein in gneiss about one inch wide. But the greyish white colors, or Zoisite varieties, are the most frequent in the U.S. These occur in columnar compositions, in which the individuals are large, at Wardsborough, (Vt.) Milford, (Conn.) but particularly at Goshen and Williamsburg, (Mass.) In the last mentioned places they exist in veins and beds of quartz situated in mica slate. In the eastern part of Maine, a radiating variety has been discovered, which is purplish red at the centres of the fibrous masses, but assumes the pistachio-green where the fibres diverge most. A variety of Zoisite in long, nearly impalpable fibres, of a dark bluish grey color, occurs with Calcareous Spar in mica slate, at Montpelier, (Vt.)

EPISTILBITE. Diplogenous Kouphone-Spar. Mohs.

Primary form. Right rhombic prism. M on M=135° 10′.

Epistilbite.

Secondary forms.

Fig. 171.

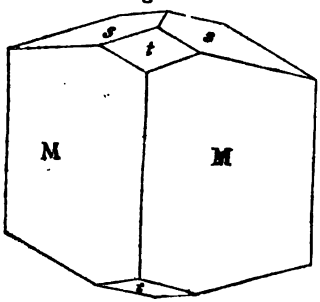
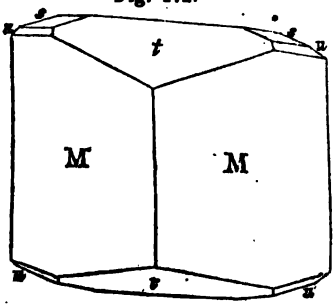


Fig. 172.



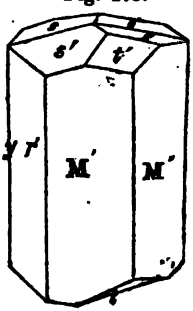
M on *t*	-	-	-	-	122°	9′
t on *t*	-	-	-	-	109	46
t on *u*	-	-	-	-	154	51
t on *s*	-	-	-	-	141	47
s on *s*	-	-	-	-	147	40

Cleavage, perfect parallel with the shorter diagonal of the prism. In other directions only an uneven fracture. Surface, the faces M shining, but uneven, not admitting of the use of the reflective goniometer; the faces *s* are dull; *t* are smooth and shining.

Lustre, on M vitreous; that of *r* pearly. Color, white. Transparent, to translucent on the edges.

Hardness = 4·5. Sp. gr. = 2·249 . . . 2·50.

Fig. 173.



Compound Varieties. Twin-crystals: axis of revolution perpendicular: face of composition parallel to one of the primary lateral faces: angle of revolution = 180°. Massive: composition granular.

1. Epistilbite, according to Dr. BREWSTER, is destitute of the two systems of colored rings, which are visible in Heulandite. The double refraction of the former mineral is also vastly greater than that of the latter; it also gives the white light of fixed polarization, and exhibits at its edges many orders of colors.

2. Before the blow-pipe, on charcoal, it froths up, and forms a vesicular enamel, but cannot be melted into a globule. In the matrass, it intumesces considerably, and gives off water. Borax dissolves a great quantity of it, and forms a clear globule. It is also soluble in salt of phosphorus, with the exception of a skeleton of silica. With solution of cobalt the enamel becomes blue. It is soluble in concentrated muriatic acid, with the exception of a fine granular residue of silica.

3. *Analysis.*

By ROSE.

Silica	58·59
Alumina	17·52
Lime	7·56
Soda	1·78
Water	14·48

4. It occurs in amygdaloidal rocks in Iceland and the Faroe Islands, along with Heulandite, and at Poonah in India.

EPSOM SALT. Prismatic Epsom-Salt. JAMIESON.

Primary form. Right rhombic prism. M on M′ = 90° 30′.

Secondary forms.

1. The primary, having the terminal edges deeply replaced, so as to form pyramids at each extremity, and likewise having the acute lateral edges truncated.

2. The same form, with the addition of tangent truncations of the obtuse lateral edges, and of the upper edges of the pyramidal terminations.

Cleavage, perfect parallel to the shorter diagonal of the primary form; less so, parallel with the faces formed by the

truncation of the pyramidal edges. Fracture, conchoidal. Surface, crystals striated vertically upon their lateral planes.

Lustre vitreous. Color white. Streak white. Transparent . . . translucent.

Rather brittle. Hardness 2·0 . . . 2·5. Sp. gr. = 1·751. Taste saline and bitter.

Compound Varieties. Botryoidal, reniform, and in the shape of crusts: composition columnar, if the particles are very delicate, the lustre becomes pearly. Pulverulent.

1. It deliquesces before the blow-pipe, but is with difficulty fusible, if its water of crystallization has been driven off. It dissolves very readily in water.

2. *Analysis.*

By Vogel.

Water	48·0
Sulphuric acid	33·0
Magnesia	18·0

3. It effloresces from several rocks, both in their original repositories, and in artificial walls. It forms the principal ingredient of certain mineral waters.

4. It occurs in Freiberg, and in its neighborhood, efflorescent upon gneiss; likewise in Scotland, in the Hartz, in Berchtesgaden, in Salzburg, at Idria in Carniola, in Bohemia and in Hungary.

It abounds in the limestone caves of Kentucky and Indiana, whose floors are often covered with it in delicate crystals, intermingled with dry earth to a considerable depth. In New York also, ten miles from Coeymans, on the east face of the Helderberg, it effloresces from the calcareous sandstone.

5. After having been purified, it is employed in medicine, as well as for the production of magnesia.

ERINITE. Dystome Copper-Baryte.

Highly crystalline: the individuals arranged in concentric coats, with rough surfaces, produced by the termination of exceedingly minute crystals; the layers often not

firmly cohering, so that they may easily be separated from one another. These layers themselves are very compact, exhibiting an uneven or imperfectly conchoidal fracture, and traces of cleavage.*

Color, a beautiful emerald green, slightly inclining to grass-green. Streak green, but paler. It is slightly translucent on the edges.

Brittle. Hardness = 4·5 . . . 5·0. Sp. gr. = 4·043.

1. *Analysis.*
By TURNER.

Oxide of copper	54·44
Alumina	1·77
Arsenic acid	33·78
Water	5·01

2. It is associated with other species of arseniate of copper, and occurs in the county of Limerick in Ireland.

ERLAN.

Massive: composition granular, also impalpable and slaty. Fracture splintery and uneven.

Color greenish grey. Lustre feebly vitreous to dull. Streak white, and possessing a resinous or oily lustre.

Hardness = 5·5 . . . 6·5. Sp. gr. = 3·0 . . . 3·1.

1. *Analysis.*
By GMELIN.

Silica	59·8
Alumina	15·9
Lime	15·7
Oxide of manganese	5·6
Soda	3·0

2. It occurs associated with Mica at Schwarzenberg in Saxony, forming a mountain mass.

* These plates form crest-like aggregations. A circumstance which greatly increases the difficulty of observing the regular forms, is the want of lustre; the surface of the concentric layers being quite dull, while there is only a slight degree of resinous lustre on the fracture.

3. From the foregoing description, Erlan would appear to be only a variety of argillite.

ESSONITE. (See *Garnet.*)

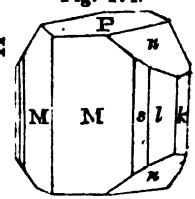
EUCHROITE. Peritomous Copper-Baryte.

Primary form. Right rhombic-prism. M on M = 117° 20′.

Secondary form.

M on M	-	-	117°	20′	HAIDINGER.
l on *l*	-	-	78	47	
s on *s*	-	-	95	12	
n on *n*	-	-	87	52	

Fig. 174.



Cleavage, parallel to the primary lateral planes, distinct; indistinct parallel to *n*.

Fracture small conchoidal, uneven. Surface, the vertical faces of the prism streaked parallel to their common edges of combination.

Lustre vitreous. Color bright emerald-green. Streak pale apple-green. Double refraction considerable. Transparent . . . translucent.

Rather brittle. Hardness = 3·5 . . . 4·0. Sp. gr. = 3·389.

1. In the matrass, it loses its water, and becomes yellowish green and friable. When heated to a certain point upon charcoal, it is reduced in an instant with a kind of deflagration, leaving a globule of malleable copper, with white metallic particles dispersed throughout its mass, which are entirely volatile upon a continued blast.

2. *Analysis.*

By TURNER.

Peroxide of copper . . .	47·85
Arsenic acid . . .	33·02
Water . . .	18·80

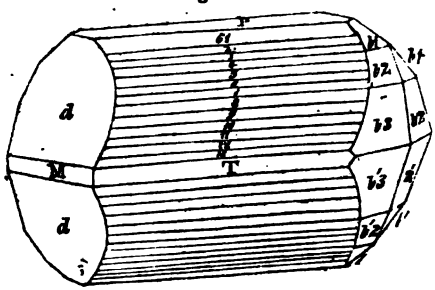
3. It was discovered at Libethen in Hungary, in quartzose mica slate.

EUCLASE. Prismatic Emerald. MOHS.

Primary form. Right oblique-angled prism. M on T = 130° 50′.

Secondary form.

Fig. 175.



P on M or T	90°	0′	PHILLIPS.	P on *c*12 -	103°	38′
M on M or T	130	52		P on *c*13 -	100	50
*b*1 on M or T	98	50		P on *b*1 -	123	10
*b*2 on M or T	100	00		P on *b*2 -	108	24
P on *c* -	124	30		P on *b*1 -	130	10
P on *d* -	124	24		P on *b*2 -	112	50
P on *c*1 -	122	28		P on *b*3 -	139	18
P on *c*2 -	121	30		*b*1 on *b*2 -	165	18
P on *c*3 -	120	10		*b*2 on *b*2′ -	143	32
P on *c*4 -	116	05		*b*1 on *b*2 -	162	20
P on *c*5 -	112	50		*b*2 on *b*3 -	169	45
P on *c*6 -	111	50		*b*2 on *b*1 -	143	20
P on *c*7 -	109	40		*d* on *d* -	105	20
P on *c*8 -	108	46		*c*1 on *d* -	140	00
P on *c*9 -	107	20		*c*1 on *b*1 -	148	10
P on *c*10 -	106	22		*c*1 on *b*1 -	115	20
P on *c*11 -	105	14				

Cleavage, highly perfect, and very easily obtained parallel to P; less distinct parallel to T. Fracture perfectly conchoidal, and very easily obtained. Surface, the faces between T and P streaked parallel to their common intersection.

Lustre vitreous. Color mountain-green, passing into blue, and white, always pale. Streak white. Transparent . . . semi-transparent, generally the first.

Very brittle and fragile. Hardness = 7·5. Sp. gr. = 3·098, a greenish-white crystal.

1. Before the blow-pipe, it intumesces in a strong heat, and becomes white. If the heat be still farther increased, it melts into a white enamel.

2. *Analysis.*

By BERZELIUS.

Silica	43·22
Alumina	30·56
Glucina	21·78
Oxide of iron	2·22
Oxide of tin	0·70

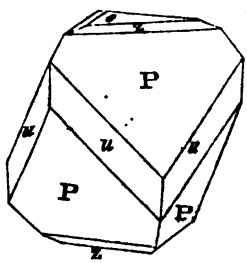
3. Nothing as yet is known with sufficient accuracy, of the mode of its occurrence in nature. The first varieties of it were brought by DOMBEY from Peru. It was afterwards found at Capao in the mining district of Villa-Ricca in Brazil, where it occurs in beautifully crystallized varieties in a chloritic slate, resting on sandstone, along with Topaz. It is generally brought to Europe in fractured crystals.

EUDYALITE. Rhombohedral Petaline-Spar.

Primary form. Rhomboid. P on P = 73° 40′.

Secondary form.

Fig. 176.



P on *u* - 106° 36′ | P on *z* - 126° 13′

Cleavage, parallel to *o* distinct; parallel to *z* less so: traces of cleavage parallel with the faces of the primary rhomboid. Fracture conchoidal or uneven. Surface smooth, but often rather uneven.

Lustre vitreous. Color brownish-red. Streak white. Translucent on the edges . . . opake.

Hardness =5·0 . . . 5·5. Sp. gr. =2·898.

1. Before the blow-pipe, it melts into a leek-green scoria. If reduced to powder, it gelatinizes with acids.

2. *Analysis.*

By Stromeyer.

Silica	52·00
Zirconia	10·89
Lime	10·14
Soda	13·92
Oxide of iron	6·85
Oxide of manganese	2·57
Muriatic acid	1·03

3. It is found in Greenland, mixed with Sodalite, Hornblende, and a mountain green variety of Feldspar.

EUKAIRITE. Selenious Polypoine-Glance.

Massive: composition granular or impalpable.

Lustre metallic. Color lead-grey. Streak white, when impressed with the nail.

Ductile. Hardness =2·0 . . . 2·5.

1. When heated alone before the blow-pipe, it emits a strong smell of selenium, and yields greyish white, and hard metallic globules. Heated with lead upon bone-ashes, it gives a globule of silver. In an open tube, it affords a precipitate of selenium and selenious acid. It prevents the reaction of copper with fluxes, and is soluble in nitric acid.

2. *Analysis.*

By Berzelius.

Selenium	31·58		26·00
Silver	43·16		38·93
Copper	25·26		23·05
Earthy matters	0·00		8·90

3. It occurs disseminated through Calcareous Spar, in the mine of Skrickerum in Smoland.

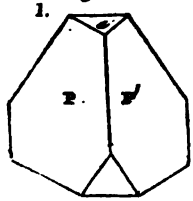
FAHLERZ. Tetrahedral Copper-Glance. MOHS.

Primary form. Tetrahedron.

Secondary forms.

Fig. 177.

1.



Kapnik.

Fig. 178.

2.

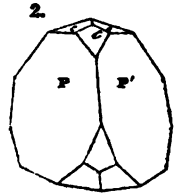
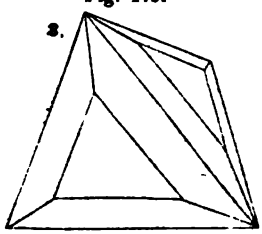


Fig. 179.

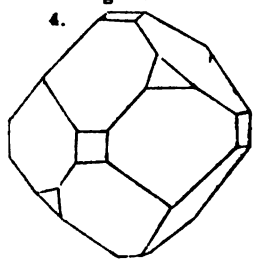
3.



Kapnik.

Fig. 180.

4.



Schwatz, (Tyrol.)

5. Rhombic dodecahedron.

6. Icosatetrahedron.

7. Trigonal dodecahedron, resulting from the extension of the bevelling planes in Fig. 179.

Cleavage, not visible, except traces of the octahedron. Fracture conchoidal, of different degrees of perfection Surface, the tetrahedron and the trigonal dodecahedron

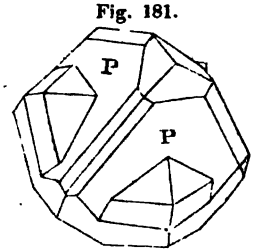
generally streaked irregularly, parallel to their common edges of combination, not rough; the dodecahedron sometimes a little rough. Some varieties are subject to tarnish.

Lustre metallic. Color steel-grey . . . iron-black. Streak unchanged, sometimes inclining to brown.

Rather brittle. Hardness = 3·0 . . . 4·0. Sp. gr. = 4·104, from Cremnitz; = 4·950 from Kapnik; = 4·798, from Schwatz.

Compound Varieties. Twin-crystals: face of composition parallel to a face of the octahedron; the individuals continued beyond the face of composition.

Fig. 181.



Dillenburg.

Massive: composition granular, of various sizes of individuals, strongly connected, and often impalpable; fracture uneven.

1. Schwarzerz has been distinguished as a subspecies under Fahlerz, but differs only in having a deeper black color, and a more conchoidal fracture.

The varieties of the present species differ somewhat in their behavior before the blow-pipe, arising chiefly, it may be concluded, from accidental mixtures, depending upon the substances with which they occur associated. Some yield arsenic when roasted, others antimony, and the residue melt in different ways. After roasting, they yield a globule of copper.

2. *Analysis.*

By KLAPROTH.

	of Fahlerz.	of Schwarzerz.
Copper	48·00	40·25
Arsenic	14·00	0·75
Antimony	0·00	23·00
Sulphur	10·00	18·50
Iron	25·50	13·50
Silver	0·50	0·30

Other varieties contain the same ingredients in other proportions. Some, moreover, contain zinc, mercury, or lead; and in some varieties as much as 13½ p. c. of silver has been discovered: in others again, a small quantity of gold is detected.

3. Fahlerz is found in beds and veins. It is accompanied by Copper Pyrites, Spathic Iron, and Quartz.

4. The varieties of a steel-grey color are found in veins near Freiberg in Saxony, and in beds in Anhalt in the county of Gömör in Hungary, in Stiria, &c.; varieties called Schwarzerz are met with in veins at Schwatz and other places in Tyrol, at Kapnik in Transylvania, at Cremnitz in Hungary; also at Clausthal and Andreasberg in the Hartz. It occurs also in the neighborhood of Dillenburg; in Mansfield; in small quantities at Airthrie, and other places in Scotland; in Cornwall, and in South America.

FAHLUNITE. Peritomous Petaline-Spar.

Primary form. Oblique rhombic prism. M on M = 109° 28′. M on P = 101° 30′. Reniform massive.

Cleavage parallel to the primary form. Fracture conchoidal . . . uneven, splintery.

Lustre vitreous. Color olive-green and oil green, passing into yellow, grey, brown, and black. Streak greyish-white. Feebly translucent on the edges . . . opake.

Hardness = 6·0 . . . 6·5. Sp. gr. = 2·61 . . . 2·66.

1. Before the blow-pipe, it becomes pale-grey, and melts on its thinnest edges. It is but slowly dissolved in glass of borax, and communicates to it the color produced by oxide of iron.

2. *Analysis.*

By TROLLE-WACHTMEISTER.

	A black massive var. Sp. gr. = 2·68.	Crystallized grey var. Sp. gr. = 2·74	Blackish grey var. Sp. gr. = 2·79
Silica	43·51	44·60	44·95
Alumina	25·81	30·10	30·70
Oxide of iron	6·35	3·86	7·22
Magnesia	6·57	6·75	6·04
Protoxide of manganese	0·00	0·00	1·90
do. mixed with ox. of iron	1·72	2·24	0·00
Soda	4·45	1·98	0·00
Potash	0·94		1·38
Fluoric acid with silica	0·16	0·00	0·00
Lime	0·00	1·35	0·95
Water	11·66	9·35	8·05

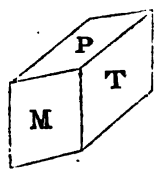
3. It occurs at Fahlun in Sweden, in a talcose or chloritic slate, with Galena and Copper Pyrites.

FASSAITE. (See *Pyroxene.*)

FELDSPAR. Orthotomous Feld-spar. MOHS.

Primary form. Doubly oblique prism.* M on T = 120°. P on M = 90°. P on T = 67° 15′.

Fig. 182.

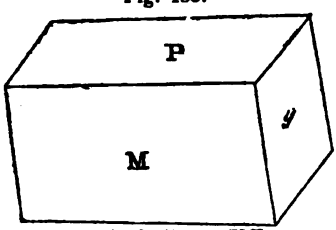


* In the description of this species, it has been found the most convenient to represent the crystals after the method of HAUY, in preference to that of BROOKE, whose projections have generally been adopted in the present work.

Feldspar.

Secondary forms.

Fig. 183.



St. Gothard.—Rossie, (N.Y.)

Fig. 184.

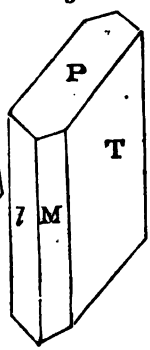


Fig. 185.

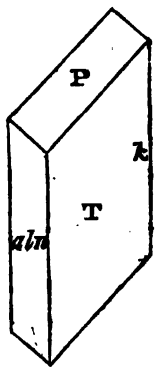
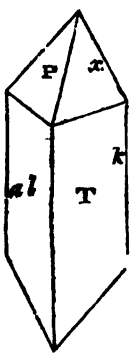


Fig. 186.



Isère.

Fig. 187.

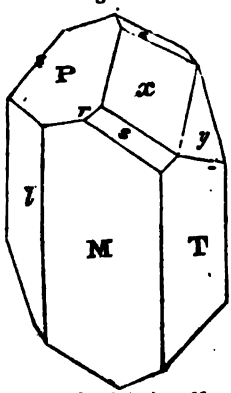
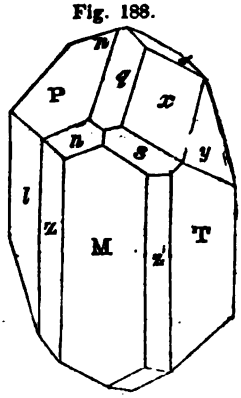
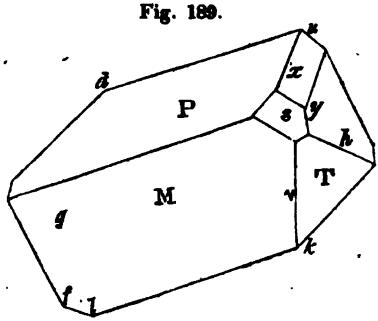


Fig. 188.



Middlefield and Becket, (Mass.)

Fig. 189.



In order to render more easily intelligible the changes suffered by the primary form, the planes M and T have the same position given them in the secondary forms, as in the figure by which the primary is illustrated. Fig. 183. (*unitaire.* HAUY.) M on $y=90°$. H. P on $y=99° 29'$. H. Fig. 184. (*prismatique.* HAUY.) M on $l=120°$. H. P on $l=111° 40'$. H. Fig. 185. (*binaire.* H.) T on $l=60$. Fig. 186. (*ditetràedre.* H.) P on $x=128° 51'$. H. Fig. 187. (*sexdécimal.* H.) x on $y=150° 45' 28''$. H. M on $s=116° 20'$. H. Fig. 188. (*synoptique.* H.) T or M on $z=150°$. M or P on $n=135°$. q on $x=164° 40'$. H. q on $s=149° 10'$. P. This is a reunion of all the modifications of Feldspar. Crystals agreeing with it, with the deficiency of planes n q and y, are found at Greenfield, near Saratoga, (N.Y.); also at Haddam, (Conn.) Others, only wanting planes n and q, occur at Governeur, St. Lawrence co. (N.Y.) Fig. 189. This is an elongation of Fig. 187, in the direction of the edge between P and M. Fig. 188, suffers the same elongation in the direction of the plane n.

Feldspar.

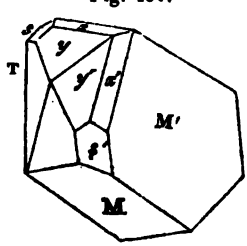
Cleavage, parallel with P highly perfect, and easily obtained; parallel with M perfect, with T obscure, though sometimes obvious. Fracture conchoidal to uneven. Surface frequently streaked in a horizontal direction; most of the other faces are smooth.

Lustre vitreous, sometimes inclining to pearly upon perfect faces of cleavage. Color white, prevalent, inclining to grey, green and red; sometimes grey, flesh-red, verdigris green. Streak greyish white. Transparent, translucent on the edge. A bluish opalescence observable in the direction of T, most distinctly in transparent varieties. The variety called moonstone, from Ceylon, appears considerably more red, and of a lower degree of transparency, if viewed perpendicularly to T, than in any other direction.

Brittle. Hardness = 6·0. Sp. gr. = 2·558, a white transparent variety; limits of the species 2.53 . . . 2·60.

Compound Varieties. Twin-crystals. 1. Face of composition parallel with the edge between P and M. (Fig. 189.) Axis of revolution perpendicular to the plane *d g f l k h u* of the same figure. Angle of revolution = 180°. See annexed figure.

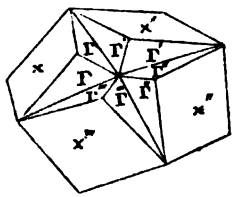
Fig. 190.



If this mode of composition be repeated on all the faces of the same form, four sided prisms, consisting of four indi-

viduals, will be formed, which are nearly rectangular, and bounded on their extremities by the faces P P and *x x*. This composition is seen in the annexed figure.

Fig. 191.



It is a frequent form, from St. Gothard.

2. Two crystals, like Fig. 187, excepting planes *x* and *s*. Axis of revolution parallel to the principal axis, face of composition parallel either to the right (Fig. 192.) or to the left faces (Fig. 193.) of M.

Fig. 192.

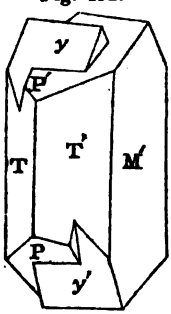
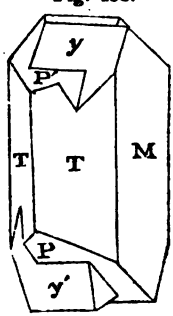


Fig. 193.

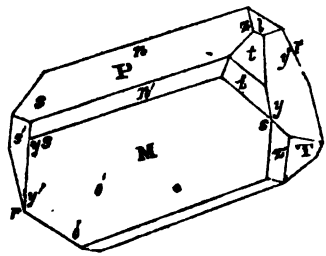


Both are found near Elbogen in Bohemia.

3. Axes of revolution perpendicular, face of composition parallel to P, angle of revolution $=180°$.

Feldspar.

Fig. 194.



La Clayette and Loire in France.

Sometimes there occurs a composition according to several of these laws at once. Massive: composition granular, of various sizes of individuals, sometimes lamellar.

1. Several distinct species were formerly included under the name of Feldspar, and variously subdivided into subspecies and varieties. First, those gray varieties which possess bright iridescent colors, were established into a particular subspecies, under the name of *Labrador Feldspar*. These are now known to comprehend varieties of Feldspar and of Labradorite. The most transparent and pure varieties, generally in implanted crystals, lining the walls of narrow veins in ancient rocks, were likewise considered as a particular subspecies, and called *Adularia*. It is made up of Feldspar and Albite. The less transparent varieties were divided into *common* and *compact Feldspar;* the first of which contained, though not exclusively, easily cleavable crystals; the second, imbedded crystals, having no distinct cleavage, and compound masses of small, or impalpable and strongly connected individuals. *Common Feldspar* contains varieties of all the species enumerated above. From it, *Clinkstone*, which is commonly a mixed mineral, and forms the mass of porphyry-slate, was distinguished as a particular species; so also was *Variolite*, consisting of small globular masses, imbedded in a mixed rock. It has not been exactly ascertained to what species Clinkstone and Variolite belong. Imbedded crystals of considerable degrees of transparency, in porphyry slate, occurring also in various other trachytic and volcanic rocks, were called *glassy Feldspar*. *Ice-spar* occurs in white transparent crystals, greatly resembling Adularia and glassy Feldspar, but implanted in the drusy cavities of rocks ejected by Mount Vesuvius. In regard to

the particular state, in which the varieties of common Feldspar occur, those which are more or less decomposed, were designated by the denomination of *earthy common Feldspar*, and considered as a particular subspecies. If the decomposition has arrived at its limits, so that the whole is converted into a more or less firmly coherent powder, *Porcelain-Earth* is formed. It is possible that porcelain-earth arises from the decomposition of several species of the Feldspar family.

Before the blow-pipe, upon charcoal, Feldspar becomes glassy, semi-transparent and white, but melts with difficulty, and only upon its edges, into a semi-transparent, vesicular glass. It is dissolved by borax, but slowly and without effervescence, into a clear globule. It is not acted upon by acids.

Analysis.

	By VAUQUELIN. Adularia.	By KLAPROTH. Common Feldspar fr. Carlsbad.
Silica	64·00	64·50
Alumina	20·00	19·75
Potash	14·00	11·50
Lime	2·00	a trace.
Oxide of iron	0·00	1·75
Water	0·00	0·75

Feldspar frequently enters into the composition of rocks, and constitutes, with Quartz and Mica, the different kinds of granite and gneiss; with Hornblende, it forms syenite and greenstone; and with Augite, the Augite-rock. To several of these rocks, large crystals of Feldspar impart a porphyritic appearance; and it is a characteristic mark of the different kinds of porphyry more properly so called, to have isolated crystals of this species distributed throughout their compact mass. Basalt, and some other allied rocks, must be considered as most intimate mixtures of Feldspar with Hornblende or Pyroxene, or with both these species, the individuals being so small as to be no longer recognizable. In several of these rocks which contain Feldspar as one of their ingredients, larger masses of it frequently form concretions separated from the rest, and assume the shape of more or less extended beds. If these be decomposed by the action of the atmosphere, and their situations be favorable, Porcelain earth is formed, among the most remarkable of which we notice those in gneiss, at Aue near Schneeberg in Saxony, and at Hafnerzell in the district of Passau. At Carclaise and Cligga in Cornwall, the porcelain earth originates in the decomposition of granitic rocks. It occurs frequently in beds along with ores of iron and titanium, with sev-

eral species of the Hornblende and Garnet families; but it may be considered as a rarity in veins, except in those which are composed of the same species of which the rocks consist which they traverse. In these, its varieties are accompanied by Axinite, Quartz, several ores of titanium, Calcarious Spar and other species; and have their surface sometimes covered with scaly particles of Talc. Sometimes the crystals have their surfaces, particularly the planes M, covered with crystals of Albite, disposed in parallel position.

The finest crystals of Adularia are found in the highest districts of St. Gothard, and the Alps of Savoy; several varieties occur also in Salzburg, the Tyrol, Bavaria, Dauphiny, the isle of Arran, in Cornwall and Wales. Very large crystals of Feldspar are found in Siberia, which are generally penetrated by Quartz, sometimes of considerable transparency. Amazon stone, a verdigris-green variety, associated with small white crystals of Albite, occurs near Fort Troitzk in the Uralian mountains. Compact Feldspar, forming the body of clinkstone-porphyry, is found in the Bohemian Mittelgebirge, in the western isles of Scotland, at Sahla in Sweden, in the Hartz, &c. Variolite has been noticed from Piedmont and Corsica. The finest varieties of porcelain earth are those from China, where it is called Kaolin, from Saxony, from Passau, and from Limoges in France.

The United States have thus far afforded few handsomely crystallized specimens of the present species, although they have been quoted from a number of localities. The most interesting of these are Rossie and Governeur in St. Lawrence co. (N.Y.) Greenfield near Saratoga in the same state, and Haddam, (Conn.) At the first mentioned place it is associated with crystallized, white Hornblende and Scapolite in limestone, and at the two last with Chrysoberyl, Garnet and Tourmaline in a granitic vein. A few crystals have been afforded, apparently belonging to this species, at Franconia, (N.H.) in a vein made up chiefly of large crystals of Epidote and Quartz. Crystallized Feldspar in small quantity, frequently accompanies Beryl in N. England; and is met with also in loose masses, lining small cavities in a rock made up of Hornblende, Augite, and massive Feldspar. The crystals are often deeply imbedded in Calcareous Spar. Under these circumstances, it has been found at Middlefield and Becket, (Mass.) Feldspar exists in very large imperfect crystals, disseminated through gneiss, and imparting to it a porphyritic appearance, throughout the primitive region of New England. It is found of a verdigris green color, crystallized and massive, at Beverly, (Mass.) The flesh-colored varieties appear to abound more in the

granite which accompanies the Atlantic coast from Connecticut to Maine, though often met with in the interior. Adularia, or opalescent varieties, though not the most strongly marked, occur in Worcester co. (Mass.) and in the granite bordering upon Lake George, near Ticonderoga, (N.Y.) as well as at Haddam, (Conn.) and Paris in Maine. Feldspar in very large, perfectly cleavable individuals, and suited to all the purposes of porcelain manufacture, abound in Charles co. (Penn.,) Delaware, in the Highlands of New York, and at several places in N. England, too numerous to be mentioned. Decomposed Feldspar is met with occasionally in granite beds, as at Andover, (Mass.); in Cheshire, (Conn.) a deposit was discovered in digging the Farmington Canal, which appears to have owed its origin to the red sandstone formation.

Several varieties of this species are used in the arts and manufactures. The purest opalescent varieties of Adularia are cut round and polished, and worn as ring stones, &c. The finest of them are from Ceylon, and are called *moon-stones*. The *sun-stone* is also used in jewellery: it exhibits, reddish and variegated patches of light, in the shape of oblique-angled parallelograms on the cleavage face T. This variety is found at Lyme, (Connecticut.) *Graphic granite* is cut for snuff-boxes, &c.: it consists of a simple variety of the present species, regularly mixed with long parallel crystals of Quartz, whose transverse angular sections bear some resemblance to certain letters. The pure varieties of Feldspar are used in the composition of the paste of porcelain, also for the enamel with which it is covered; and the decomposed variety, or porcelain earth itself, is the most important material in that department of manufactures.

Appendix to Feldspar.

i. *Mikroclinous Felsite.* Breithaupt.

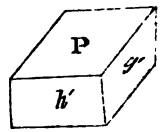
P on M = 112° 15′. P on T = 90° 21′. M on T = 118° 35′.
Cleavages very perfect.
Hardness = 7·75 . . . 8·0. (scale of Breithaupt.)
Sp. gr. = 2·562, reddish to liver-brown, from Arendal.
2·565, reddish white, from Arendal.
2·567, grey, with blue opalescence, from Friedrichsvairn.
2·568, do. in small pure cleavage forms.

The composition of Mikroclinous Felsite is, according to KLAPROTH,

Silica - - - -	65·00
Alumina - - - -	20·00
Potash - - - -	12·25
Oxide of iron - - - -	1·25
Magnesia - - - -	a trace.
Water - - - -	0·50
	99·00

ii. *Murchisonite.* LEVY.

Fig. 195.



P on g' - - - -	90° 00′
g on h' - - - -	90 00

The two cleavages which are at right angles, are like Feldspar; the third has a nacreous lustre, and is as easily obtained as the others. The plane P of this figure is not afforded by cleavage in common Feldspar.

Color white, with a tinge of red. Opake.

It occurs at Heavitree near Exeter, forming a compact rock, associated with Quartz, Mica and black Tourmaline; and is connected with the red marl.

iii. *Ryakolite.* ROSE?

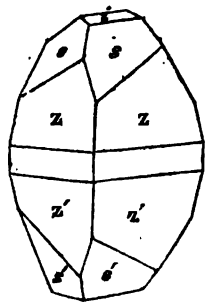
The experiments of G. ROSE upon the glassy Feldspar, are said to have rendered it apparent that its angles are different from those of Feldspar, and from the above enumerated varieties, proposed as species. Its sp. gr. = 2·576. It occurs in the lava of Vesuvius, and in that of the Lacher Lake.

FERGUSONITE.

Primary form. Right square prism.

Fergusonite.

Secondary form. Fig. 196.



s on *s* - 100° 30′ | *z* on *z′* - 159°

Cleavage, traces parallel to *s*. Fracture perfectly conchoidal. Surface rather uneven.

Lustre imperfectly metallic, inclining to resinous. Color dark brownish black; in thin splinters, pale. Streak very pale brown, like Rutile. Opake; in thin splinters, translucent.

Brittle. Hardness = 5·5 . . . 6·0. Sp. gr. = 5·838.

1. Before the blow-pipe, it loses its color and becomes pale greenish-yellow, but alone, is infusible. It is entirely dissolved in salt of phosphorus, but some particles remain a long time unaltered. The pale greenish globule becomes opake by flaming, or on cooling, when very much saturated. Before the whole portion has been dissolved, it assumes a pale rose color in the reducing flame.

2. *Analysis.*

By Hartwall.

Columbic acid - - -	47·75
Yttria - - -	41·91
Oxide of Cerium - - -	4·68
Zirconia - - -	3·02
Oxide of tin - - -	1·00
Oxide of uranium - - -	0·95
Oxide of iron - - -	0·34

3. It is found imbedded in Quartz at Kikertaursak, near Cape Farewell in Greenland.

FERRUGINOUS PLATINA.

In crystals and grains. The form of the crystals described as cubical.

Color dark platina-grey. Surface tarnished, like meteoric iron. Hardness = 8·0 . . . 8·5. (Scale of BREITHAUPT.)

Malleable. Sp. gr. = 14·6 . . . 15·7. It is magnetic; and in some cases not only attracts, but repels the needle.

1. It gives, by chemical trials, evidence of a considerable portion of iron.

2. It is found in the platina sand from Nijnotagulisk in the government of Perme in Siberia.

3. Whether it be specifically distinct from Native Platina, still admits of a doubt.

FETTBOLE.

Massive; composition impalpable. Fracture conchoidal. Color liver-brown. Lustre resinous. Opake. Hardness = 1·50 . . . 2·0. Sp. gr. = 2·249. It falls to pieces in water, attended with a crackling noise. According to KERSTEN, it consists of a tri-silicate of iron, with 9 proportionals of water. It is, without doubt, an accidental mixture of these principles, resulting from the decomposition of some one or more mineral species.

FETTSTEIN. (See *Nepheline.*)

FIBROLITE. (See *Kyanite.*)

FIGURE-STONE. Glyptic Atelene-Picrosmine.

Massive: composition impalpable. Fracture coarse splintery, imperfectly slaty.

Color white, grey, green, yellow, red and brown; none of them bright. Acquires some lustre in the streak. Translucent, in most cases, only on the edges.

Hardness = 2·0 . . . 2·5. Sp. gr. = 2.815 . . . 2·9.

1. Before the blow-pipe, it is infusible, but becomes white. It is partly soluble in sulphuric acid, leaving a siliceous residue.

2. *Analysis.*

	By Klaproth.	By Thomson.
Silica	54·50	49·816
Alumina	34·00	20·596
Potash	6·25	6·800
Lime	0·00	6·000
Oxide of iron	0·75	1·500
Water	4·00	5·000

3. It is brought from China. Less characteristic varieties have been found also in Transylvania and in Saxony.

4. It is cut by the Chinese into various ornaments and grotesque shapes.

Fiorite. (See *Opal.*)

Flint. (See *Quartz.*)

FLUCERINE. Rhombohedral Tungstic-Baryte.

Primary form. Rhomboid, of unknown dimensions.

Six-sided prisms, plates and amorphous masses.

Cleavage most distinct perpendicular to the axis, or parallel with the base of the hexagonal prism.

Fracture uneven and splintery.

Color reddish white to yellow. Streak white to yellow. Opake or translucent on the edges.

Hardness =5·50 . . . 5·75. Sp. gr. =4·7.

1. Heated in the matrass, or the glass-tube, it corrodes the glass. Alone, it does not fuse, but its color changes to brown; with borax and salt of phosphorus, it gives a red or orange colored globule, which becomes pale on cooling.

2. *Analysis.*

	By Berzelius.
Fluoric acid	16·24
Peroxide of cerium	82·64
Yttria	1·12

3. It occurs at Finbo and Brodbo, near Fahlun, imbedded in Albite and Quartz.

APPENDIX TO FLUCERINE.

i. *Fluate with excess of base.*

Traces of crystalline structure. Color yellow.

It resembles porcelain jasper. Before the blow-pipe, it scarcely differs from the foregoing description. If heated alone on charcoal, it turns black, at an incipient redness; but assumes on cooling, successively, dark brown, red and orange tints. It is composed, according to BERZELIUS, of

Fluoric acid - - -	10 85
Peroxide of cerium - - -	84·20
Water - - -	4·95

It is found at Finbo.

ii. *Fluate of Yttria and Cerium.*

Earthy; found in masses seldom exceeding the size of a pea. Color pale red, sometimes deep red, yellow or white. Easily scratched by the nail.

According to BERZELIUS, it is a mechanical mixture of fluate of yttria with fluate of cerium and silica. It gives nearly the same reactions as the neutral fluate, first described.

FLUELLITE. ——— Fluor Haloide?

Octahedron with a rhombic base. P on P′ = 144°. P on P″ over the summit = 109°.

Color white. Transparent.

1. It occurs in minute crystals of the form above mentioned, having its most acute solid angles replaced, along with the Wavellite from Cornwall. It has been found to contain alumina and fluoric acid.

2. Its hardness and specific gravity require to be known, before its place in the natural system can be correctly determined.

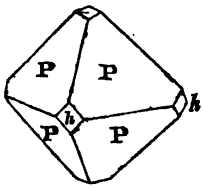
FLUOR. Octahedral Fluor-Haloide. MOHS.

Primary form. Regular octahedron.

Fluor.

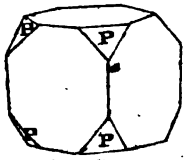
Secondary forms.

1. Fig. 197.



St. Gallen, Stiria.

2. Fig. 198.

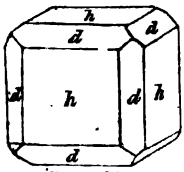


St. Gallen.

3. Cube.

The most common form.

4. Fig. 199.

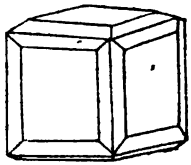


Derbyshire.
Trumbull, (Conn.)

5. Rhombic dodecahedron.

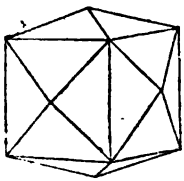
Ehrenfriedersdorf, Sax.

6. Fig. 200.



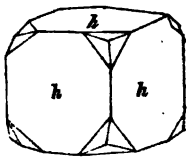
Derbyshire.
Trumbull, (Conn.)

7. Fig. 201.



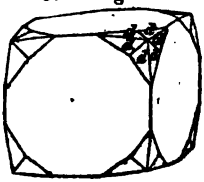
St. Agnes, Cornwall.

8. Fig. 202.

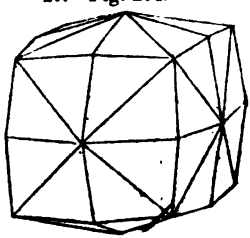


Zinnwald, Saxony.

9. Fig. 203.



10. Fig. 204.



In addition to the foregoing, are found crystals in the form of a cube, with its edges replaced by three planes, and also having the additional planes of Fig. 202. PHILLIPS describes a crystal in his possession, whose general form is that of a cube, but whose edges are replaced by seven planes, and whose solid angles are replaced by more than four times this number, and resulting in a form bounded by 322 planes.

Cleavage, parallel with the faces of the regular octahedron perfect: rarely also, parallel with the faces of the rhombic dodecahedron and cube. Fracture conchoidal, more or less perfect.

Surface. The cube generally smooth. Octahedron often rough and drusy. Dodecahedron various, being sometimes smooth, at other times rough and drusy. Sometimes the faces of the cube and the tetraconta-octahedrons are curved.

Lustre vitreous.

Color white, though not very common, and seldom pure. Generally wine-yellow or violet-blue. Among its brightest colors are emerald and pistachio-green, sky-blue, rose-red, and crimson-red. The dark blue colors bordering upon black, are probably due to bituminous impregnations. Frequently different shades of colors are disposed in coats parallel to the faces of the cube, or symmetrically distributed along the edges or solid angles of crystals.

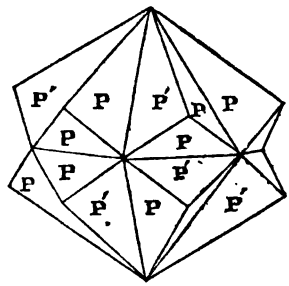
Streak white. It is sometimes slightly tinged, if the colors be very deep.

Translucent... transparent. Sometimes different colors appear by reflected and by transmitted light.

Brittle. Hardness $=4{\cdot}0$. Sp. gr. $=3{\cdot}140$.

Compound Varieties. Twin-crystals. Face of composition parallel to one of the faces of the octahedron; the individuals having one of their axes parallel, are continued beyond the face of composition, and particles of the one are observed formed upon the faces of the other. See annexed figure.

Fig. 205.



Implanted globular shapes, rare: surface drusy, composition columnar. Massive: composition granular, the individuals being of various sizes; if the composition be impalpable, its fracture becomes flat conchoidal and splintery, the surface of fracture being scarcely glimmering. Massive varieties are also sometimes composed of columnar particles, generally of considerable size, seldom thin or diverging, but very often forming a second curved lamellar composition. The faces of composition are sometimes irregularly streaked, more generally uneven and rough.

1. Before the blow-pipe, it decrepitates, and becomes phosphorescent, but loses its color and melts at last into a rather opake globule. It phosphoresces likewise, if thrown upon ignited charcoal or heated iron. Several varieties which exhibit this property in particularly bright green colors, have been called *Chlorophane* or *Pyro-smaragdus*. If exposed to a high degree of temperature, they lose the property of again

showing this phenomenon. Sulphuric acid decomposes the powder of the mineral, attended with the evolution of fluoric acid, which is recognized by its property of corroding glass. Several varieties, particularly the sky-blue ones, lose their color on being exposed to the light.

2. *Analysis.*

By KLAPROTH.

Lime	67·75
Fluoric acid	32·25

3. Fluor does not enter as a regular constituent into the composition of rocks. It is not very frequently found in beds. More generally it occurs in veins, with other minerals, in primitive or transition rocks. Very seldom it is associated with petrifactions, as the blue varieties of Derbyshire, with entrochites.

4. The most beautiful crystals of Fluor are found at Beeralston in Derbyshire, at St. Agnes and other places in Cornwall, and at Zinnwald in Bohemia. Large crystals, generally twins, of the cube, of handsome blue and green colors, occur at Alston in Cumberland, which frequently contain water. Beautiful, dark blue, perfect crystals, having their edges and angles highly replaced, have been found along with Quartz in porphyritic greenstone, near Gourock in Renfrewshire. Well defined crystals of the primary form, of an apple green color, occur at Moldavia in the Bannat of Temeswar. Rose red octahedrons, occasionally of great magnitude, are met with near Champuni in Savoy. The Saxon varieties are generally of a cubical form, and of violet blue, or wine yellow, colors. The compound uncleavable varieties (*compact fluor*) are chiefly from Strassberg and Stollberg in the Hartz, from Cornwall and Sweden. The friable ones, (*earthy fluor*,) are found in Saxony, England and Norway. The chlorophane occurs at the Pednandrae mine in Cornwall, and at Ecatherineburg in Russia. Specimens from the latter place have been observed to phosphoresce simply from the warmth of the hand.

The United States have not proved very productive in handsome varieties of Fluor. The most remarkable region in this country for the present species, is situated in the State of Illinois, along the country south-west from Cave rock on the Ohio for thirty miles, in Gallatin co. It exists in nodular masses, disseminated through the soil, or occurs imbedded in a compact limestone. Its crystals are often large, and present a diversity of colors; the prevailing one, however, is a dark purple, almost black, but appearing extremely rich by transmitted light. The darker colored varieties emit a bituminous odor when cleaved. Green octahedrons, sometimes an inch in diameter, have been found imbedded

in a crystalline Quartz in the notch of the White Mountains in New Hampshire. Fluor (variety *Clorophane*) of several colors accompanies the Topaz and Magnetic Iron-Pyrites, at Trumbull, (Conn.) where it also forms entire veins in gneiss. An emerald green, massive variety occurs in narrow seams in mica slate, at Putney in Vermont. Other American localities are the following: Smith co. (Tennessee) in white and purple cubes; in Virginia, near Woodstock, Shenandoah co., in small loose masses, in the fissures of a limestone rock containing shells; also at Shepherdstown on the Potomac, in veins of white limestone, of red and purple colors; in New Jersey, near Franklin furnace; in New York, at Amity, in thin seams in white limestone, along with yellow Tourmaline, Hornblende and Spinel; and at Lockport and its vicinity, in white cubes, in black limestone, associated with crystallized Calcareous Spar and Celestine; in Massachusetts, at the Southampton lead-mine.

FORSTERITE.

Primary form. Right rhombic prism? M on M = 128° 54′.

Secondary form. The primary, having its terminal, and its acute lateral, edges replaced by single planes: the inclination of the faces on the terminal edges to the base = 126° 6′.

Cleavage, parallel with P.

Color white. Translucent.

1. It is inferred from the experiments of CHILDREN, to be a silicate of magnesia.

2. It is found with Spinel and Pyroxene on Mount Vesuvius.

FRANKLINITE. Dodecahedral Iron-Ore. MOHS.

Primary form. Regular octahedron.

Secondary form. Regular octahedron, with its edges truncated. Irregular forms, grains.

Cleavage parallel with the primary form, but not perfect. Fracture conchoidal. Surface of all the faces smooth.

Lustre metallic. Color iron-black. Streak dark brown. Opake.

Brittle. Acts upon the magnetic needle, but does not exhibit magnetic poles. Hardness =6·0 . . . 6·5. Sp. gr. =5·091.

Compound Varieties. Massive: composition granular, strongly connected.

1. Before the blow-pipe, alone on charcoal, it presents the appearances of Magnetic Iron-Ore; but with soda in a good reduction fire, it emits the white smoke of Zinc, and becomes green when heated with the same reagent upon platina-foil in the oxidation-heat of the instrument.

2. *Analysis.*

	By Berthier.	By Thomson.
Peroxide of iron	66·00	66·10
Red oxide of manganese	16·00	0·00
Oxide of zinc	17·00	17·425
Deutoxide of manganese	0·00	14·96
Silica	0·00	0·204
Water	0·00	0·560

3. Franklinite is found at Franklin furnace in Hamburg, (N. Jersey,) accompanied by Red Zinc-Ore, Calcareous Spar and Garnet. The most perfect crystals at this locality are imbedded in the Red Zinc-Ore; those engaged in the Calcareous Spar, and associated with Garnet, exhibit rounded faces, resulting from the truncation of the solid angles of the primary form. A more remarkable deposit of the present species occurs at Stirling in the same region, where it exists in a powerful vein, in which, cavities occasionally appear containing crystals of a very large size, from one to three inches in diameter, and which are associated with Troostite.

Gabbronite. (See *Scapolite.*)

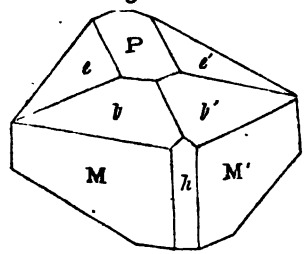
GADOLINITE. Hemi-prismatic Melane-Ore. Partsch.

Primary form. Oblique rhombic prism. M on M = 115°.

Gadolinite.

Secondary form.*

Fig. 207.



M on M'	-	115° c. g.	b on b'	-	120°
P on h	-	98	e on e'	-	120
M on e	-	100	b' on e'	-	130
M on b	-	153			

Cleavage, so imperfect, that its direction has not been ascertained. Fracture conchoidal.

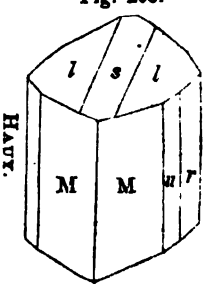
Lustre vitreous, inclining to resinous. Color greenish-black, very dark. Streak greenish-grey. Translucent on the edges, almost opake.

Hardness =6·5 . . . 7·0. Sp. gr. =4·0 . . . 4·3.

* The Abbé Hauy gives the following figure and measurements for this substance, which, however, are only claimed to be approximations.

M on l	143°	12'	Hauy.
M on r	125	16	
M on u	160	32	
l on l	142	8	
l on r	108	50	
l on s	161	11	
r on s	90	00	
r on u	144	44	

Fig. 208.



Compound Varieties. Massive: composition impalpable. Fracture conchoidal.

1. As soon as the heat of the blow-pipe is communicated to thin fragments, they exhibit an instantaneous glow. In the strongest heat the mass swells up, turns greyish green, and is traversed by numerous fissures. In very thin fragments, it melts with difficulty, into a greyish glass. Some varieties, according to BERZELIUS, become white, and swell into cauliflower-like masses, without suffering fusion; while others, according to PHILLIPS, fuse readily, after some decrepitation, into a black glass.

2. *Analysis.*

By BERZELIUS.

	fr. Finbo.	fr. Brodbo.	fr. Korarfvet.
Yttria	45·00	45·95	47·62
Protoxide of iron	11·43	12·63	8·30
Protoxide of cerium	17·92	18·20	3·40
Silica	25·80	24·16	29·20
Lime	0·00	0·00	3·47
Oxide of manganese	0·00	0·00	1·42
Glucina	0·00	0·00	1·70
Water	0·00	0·00	5·20

3. Gadolinite occurs in gneiss and granite, and is chiefly accompanied by Feldspar, Albite and Quartz. Its localities are Ytterby near Stockholm, and Finbo and Brodbo near Fahlun in Sweden. It is also found in Greenland.

GAHNITE. (See *Automalite.*)

GALACTITE.

A name which has been given to a mineral found in the trap of Kilpatrick, near Glasgow; but which is probably a variety of Analcime.

GALAPEKTITE. (See *Halloysite.*)

GALENA. Hexahedral Polypoione-Glance.

Primary form. Cube.

Secondary forms.

1. Cube, with the angles truncated.

2. Regular octahedron. Bleiberg in Carinthia. Southampton, (Mass.)

3. Octahedron, with its angles truncated. Cumberland, England.

4. Octahedron, with its angles replaced by four planes resting on the octahedral planes.

5. The same, with the truncation of the summits of the four-sided pyramids situated upon the angles of the octahedron.

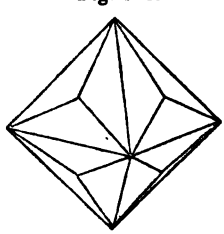
6. The octahedron, with the edges truncated.

7. The octahedron, with the edges bevelled, and the angles truncated,—the truncating planes being the primary faces of the species.

8. The same, excepting that the edges are replaced by three planes, (*pentacontaèdre*, HAUY,) from Feistriz in Stiria.

9. The trigonal icositetrahedron.

Fig. 208.



Cleavage, parallel with the cube, highly perfect, and easily obtained. Fracture rarely discoverable. Surface, the cube and the trigonal-icositetrahedron streaked parallel to the edges of combination with the octahedron. Sometimes subject to tarnish.

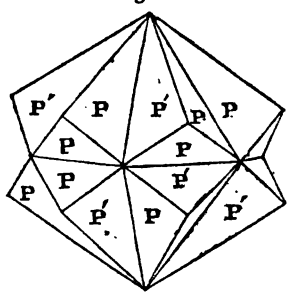
Lustre metallic. Color pure lead-grey. Streak unchanged.

Galena.

Rather sectile. Hardness =2·5. Sp. gr. = 7·568, of a cleavable variety.

Compound Varieties. Twin-crystals; face of composition parallel, axis of revolution perpendicular to a face of the octahedron.

Fig. 209.



Kapnik, Transylvania.

Reticulated, tabular, and some other imitative shapes, the individuals of which are often still observable. Massive: composition granular, of various sizes of individuals, sometimes impalpable. In this case the color becomes pale, or whitish lead-grey, the fracture even, or flat conchoidal, and the streak shining. The granular particles of composition sometimes become elongated, or compressed in one direction, and then approach to lamellar or columnar ones. Pseudomorphoses of Pyromorphite. Plates, &c.

1. Before the blow-pipe, it melts, if heated with precaution, and yields after the sulphur has been driven off, globules of metallic lead. It is partly soluble in nitric acid, and leaves a white residue.

2. *Analysis.*

By Thomson.

Lead	85·13
Sulphur	13·02
Iron	0·50

Galena.

3. Galena is frequently found in veins, but also in great quantity in beds, particularly in limestone rocks. In beds, it is accompanied by various other ores of lead, by Blende, Copper and Iron-Pyrites; in veins, it occurs along with ores of silver, copper and antimony, sometimes with Native Gold. In both cases it is attended by Fluor, Calcareous Spar and Quartz.

4. The remarkable beds of Galena in Carinthia, which occur in limestone, and are worked at Deutsch-Bleiberg, Windisch-Bleiberg, Windisch Kappel, Ebriach, and other places, possess in several respects a striking similarity to those of Derbyshire, Durham and Northumberland, in England. It is also found in beds in older rocks, as in Stiria, Carinthia, &c. In veins, it occurs in rocks of different ages, from gneiss to the coal formations, in various parts of Saxony and Bohemia, in the Hartz, in Anhalt, in Hungary, in Transylvania, in France, in Scotland, and in many other European countries. Fine crystals have been obtained from the Pfaffenberg mine near Neudorf in Anhalt, from Saxony, from Transylvania, from Cumberland, Durham, &c. Compact Galena chiefly occurs at Freiberg in Saxony, in the Hartz, in Carinthia, and at the Lead Hills in Scotland. The *Specular Galena*, or *Slickensides*, which consists of an extremely thin coating of this species on Quartz, or on some other mineral, is found principally in some of the mines of Derbyshire.*

American localities of Galena are exceedingly numerous, although we have but few valuable mining deposits of this species. The most important are those situated in Missouri, in the counties of Washington, St. Genevieve, Jefferson and Madison; and at Galena in the north-west part of the State of Illinois. In these regions the Galena is found in an alluvial deposit of clay and marl, through which are disseminated masses of Quartz,—the whole resting upon a secondary limestone. Numerous localities might also be quoted in Kentucky, Ohio, Tennessee, Virginia and Maryland. In Pennsylvania, it occurs on Perkiomen creek, 23 miles from Philadelphia, accompanied by several of the salts of lead; and in New York at Ancram, and in Livingston's manor in Columbia co. In Connecticut, besides thin veins at Middletown, Huntington, and South-

* The Quartz or mineral on which it is formed, constitutes the vein stone, adhering to both walls of the vein; when these vein stones meet, each being thinly coated by Galena, they are readily separated by the pick, and indeed sometimes fly off spontaneously, with a loud explosion.

ington, a deposit has lately been discovered at Brookfield, whose extent is not yet fully developed. In Massachusetts, numerous veins have been discovered in Hampshire county, the most important of which exist at Southampton and Northampton. In addition to the foregoing, it may be added that Galena has been found in Vermont and Maine.

Galena is the source of the principal part of the lead of commerce. On account of its generally containing a small quantity of silver, it is also employed to a considerable extent for the extraction of this metal. Potters use either the Galena reduced to powder, or the litharge produced from it, for glazing coarse pottery.

GANOMATITE.

Massive: in crusts, and kidney-shaped. Fracture conchoidal. Lustre vitreous. Color yellow, to brown and green.
Sp. gr. = 2·926.

Other properties and locality, unknown.

GARNET. Dodecahedral Garnet. MOHS.

Primary form. Rhombic dodecahedron.

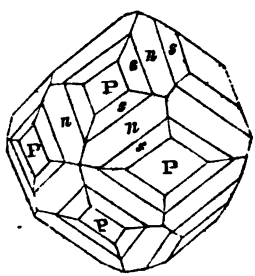
Secondary forms.

1. Dodecahedron, with the edges truncated. Hamburg, (N. J.)

2. Trapezohedron. Washington, (Conn.) Common.

3. Dodecahedron, with the edges replaced by three planes, (*trié marginé*. HAUY.)

Fig. 210.

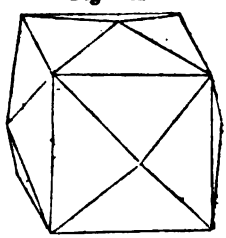


Franconia, (N. H.)

4. The same as 1. with the addition of the truncation of the acute solid angles of the dodecahedron by four planes resting upon the edges of the dodecahedron, (*uniternaire.* HAUY.) Bannat of Temeswar.

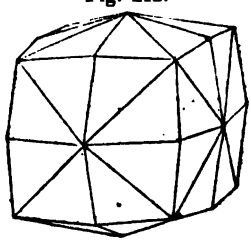
5. Icositetrahedron.

Fig. 211.



6. Tetraconta-octahedron.

Fig. 212.



Mussa, Piedmont.

Irregular forms and grains.

Cleavage, parallel with the dodecahedron, but very indistinct. Fracture conchoidal, more or less perfect, generally uneven. Surface, the crystals sometimes streaked parallel to the edges of combination with the dodecahedron: the dodecahedron itself is sometimes streaked parallel to its edges of combination with the cube. The surface of the grains is uneven, rarely granulated.

Garnet.

Lustre vitreous, inclining to resinous in some varieties, more nearly the latter. Color red, brown, yellow, white, green, black; except some red colors, none of them are bright. Streak white. Transparent... translucent.

Hardness = 6·5 ... 7·5. Sp. gr. = 3·615, Grossular; 3·701, Melanite; 3·769, brown, common Garnet; 3.788, Pyrope; 4·098, crystals of precious Garnet, Tyrol; 4·125, grains of precious Garnet, Ohlapian; 4·179, crystals of Almandine; 4·208, crystals of precious Garnet, Haddam.

Compound Varieties. Massive: composition granular, of various sizes of individuals, and often, even impalpable, easily separated, or strongly coherent; faces of composition irregularly streaked, uneven or rough. If the composition be impalpable, the fracture becomes uneven and splintery. The composition is sometimes thick lamellar, and bent, the face of composition being pretty smooth.

1. From the diversity in hardness and specific gravity, which exists among the numerous varieties of Garnet, it is highly probable that the present limits of the species are too wide, and that they include individuals which will hereafter be discovered to constitute independent species. It is not at all likely, however, that discoveries will take place in coincidence with the arbitrary and empirical separation of the species into varieties, as found in the older treatises of mineralogy; for these are founded almost entirely upon accidental circumstances. These subdivisions from their present currency in books, require to be noticed. *Grossular* occurs only in imbedded crystals of the forms of icositetrahedron, and combinations of it with the dodecahedron. Its colors are confined to asparagus green and mountain green. *Pyreneite* also occurs only in small blackish, imbedded crystals in limestone. *Melanite* possesses the form of modification 1, is generally imbedded, and of a velvet-black color. *Pyrope* occurs only in grains, and is remarkably distinct, from its pure translucency and blood red color, which is not found in any other variety. Among the varieties known under the simple denomination of Garnet, are found every simple form and combination noticed

above, among the crystalline varieties, also grains and massive specimens: it contains likewise every shade of the series of colors, and it is therefore only in the particular union of several of these properties, that we must look for the distinction of the above mentioned varieties. The color of *Precious Garnet* is always red; its crystals are found imbedded. It is the only variety that occurs in grains, and if compound, it presents lamellar composition. *Common Garnet* seldom occurs in red colors, and these are of dull shades; its crystals are generally implanted, and the composition is granular, but not impalpable. *Colophonite* is a compound variety of yellowish-brown and reddish-brown, or oil green and honey-yellow colors, consisting of roundish particles of composition, which are easily separable. If the composition be impalpable, Allochroite is formed. The two varieties *Aplome* and *Essonite*, appear less connected with the rest of the species, than any of those which have been enumerated. The first of these occurs in dodecahedrons, having the acute, solid angle replaced by tangent planes, parallel with which cleavage takes place, thus indicating the cube as the system of crystallization to which they belong. The latter, according to HAUY, presents traces of cleavage parallel to a prism of 101° 40′. It is generally found in grains; but the optical examinations of Dr. BREWSTER and M. BIOT, render it extremely probable that it is only a variety of Garnet.

2. Before the blow-pipe, Garnet melts without effervescence, pretty uniformly, into a black globule, presenting a vitreous lustre. Some varieties present a slight effervescence, but finally yield the same result. The bead obtained by melting is frequently attracted by the magnet.

3. *Analysis.*

	KLAPROTH.			SIMON.	VAUQUELIN.		KL. LAUGIER.	KL.
	Grossular.	Melanite.	pr. Garnet.	Colophonite.	Allochroite.	Pyreneite.	Pyrope.	Aplome.	Essonite.
Silica - -	44·00	35 50	35·75	37·00	35·00	43·00	40·00	40·0	38·80
Alumina - -	8·50	6·00	27·25	13·50	8·00	16·00	28·50	20·0	21·20
Lime - -	33·50	32·50	0·00	29·00	30·00	20·00	3·50	15·5	31·25
Ox. of iron - -	12·00	24·25	36·00	7·50	17·00	16·00	16·50	2·0	6·50
Ox. of manganese	a trace.	0·40	0·25	4·75	3·50	0·00	0·25	2 0	0·00

Besides these, Colophonite contains 6·5 p. c. of magnesia, 0·5 p. c. of oxide of titanium, and 1·0 of water; Allochroite, 6·0 of carbonate of lime; Pyreneite, 4·0 of water; and Pyrope, 10 of magnesia, and 2·0 of chromic acid.

4. Garnet occurs in many rocks with a degree of constancy, and in a quantity almost sufficient to be regarded as an essential ingredient in

their composition. It is particularly plentiful in mica-slate, gneiss, granite, and also exists, though in smaller quantity, in limestone, chlorite-slate, serpentine and lava. Precious Garnet occurs in slaty primitive rocks; Grossular and Pyrope are found in serpentine, the latter also in other rocks, through the decomposition of which it is brought into the soil. Melanite is imbedded in lava, and occurs implanted in geodes ejected by Vesuvius, also in primitive limestone. Pyreneite is found in a blackish limestone. Common Garnet is found in beds, consisting either wholly, or for the greater part of its varieties, accompanied by Magnetic Iron-Ore, Hornblende and Epidote. Allochroite is found under similar circumstances. Colophonite forms veins in primitive rocks.

5. Grossular is found with Idocrase in a kind of serpentine, in Kamtschatka; Melanite, at Frescati and Albano near Rome; Pyrope, near Bilin in Bohemia, and in the serpentine of Zöblitz, and the forest of Zell in Saxony; Pyreneite, near Barèges in France. Precious Garnet, sometimes in large, but not very transparent crystals, and often covered with a coat of chlorite, occurs at Fahlun in Sweden, and in many localities of the Tyrol, Carinthia, Stiria, Switzerland, Hungary, &c. The varieties possessing lamellar compositions, are found in Greenland; Common Garnet, in large quantities, at Arendal in Norway, Fahlun, Langbanshytta in Sweden, Orawitza in the Bannat in Hungary, Stiria, Siberia and many other places. Colophonite is known from Arendal; Allochroite from Drammen in Norway, and the valley of Zem in Salzburg. The transparent crystals of precious Garnet, called *Almandine*, are chiefly brought from Ceylon and Pegu, where they occur in the sand of the rivers. The Aplome comes from Lena in Siberia, Schwarzenberg in Saxony, and from Bohemia and England; the Cinnamon stone from Ceylon.

Several very beautiful varieties of Garnet have been found in the U. States. Small, but exceedingly perfect, dodecahedrons, of a handsome red-brown color, and transparent, occur at Hanover, (New Hampshire,) disseminated through hornblende-gneiss. Dark blood-red, and highly splendent crystals, (modification 3,) present themselves in geodes, in massive Garnet, Calcareous Spar, and Magnetic Iron-Ore, at Franconia, (N. H.) Splendid geodes, of a transparent, cinnamon-brown colored variety, (of modification 1,) are found, accompanied by Scapolite, in white limestone, at Carlisle, (Mass.): less remarkable specimens, also, of the same variety, occur at Boxborough in the same region. Geodes of Melanite, of great beauty, in which the crystals sometimes are above an inch in diameter, occur at Franklin furnace, in New Jersey, in limestone, as-

sociated with Quartz and greenish Feldspar. A rich, red colored Garnet, in irregular trapezohedrons, sometimes of considerable size, is found at Haddam, (Conn.) associated with Chrysoberyl, Automalite, and Columbite. Very perfect trapezohedrons, of a reddish brown Garnet, abound in mica slate, in Munroe, Washington, and several neighboring towns in Connecticut. Large dodecahedral crystals, of a dull red color, and not possessed of smooth faces, are found in chlorite slate, at Marlborough and New Fane, in Vermont: also in mica slate, in Chesterfield, (Mass.) A blackish brown variety, in large crystals, (of modification 1,) is found in limestone, at Lyme, (Conn.) Colophonite in large grains, possessing rich colors, constitutes a powerful vein, in gneiss, at Willsborough, (N.Y.) on Lake Champlain. At Roger's Rock, also, upon Lake George, is found a much finer grained variety, of yellow and red colors. Yellow and reddish, brown Garnet, is found, along with Franklinite, in limestone, at Franklin Furnace, in New York.

GAY LUSSITE. Peritomous Natron-Salt.

Primary form. Oblique rhombic prism. M on M=68° 50′. P on M = 96° 30′.

Cleavage, parallel with the faces of the primary form, perfect; most so, parallel with M. Fracture conchoidal.

Lustre vitreous. Color white. Transparent. Very brittle. Hardness =2·5. Sp. gr. =1·9.

1. When heated, it decrepitates. Before the blow-pipe, it melts rapidly. In nitric acid, it dissolves with a brisk effervescence, giving rise to crystals of nitrate of soda.

2. *Analysis.*

By Boussingault and Cordier.

Carbonate of soda	33·96
Lime	31·39
Water	32·20
Carbonic acid	1·45
Alumina	1·00

3. It is found in great abundance, disseminated in detached crystals through clay, near Lagunilla in Colombia.

GEHLENITE. Pyramidal Dystome-Spar.

Primary form. A right square prism.

Cleavage, in traces, parallel with the base.

Lustre resinous, inclining to vitreous. Color, different shades of grey, mostly yellowish; none of them bright.

Opake. Sometimes faintly translucent on the edges.

Brittle. Hardness =5·5 . . . 6·0. Sp. gr. =3·029.

1. Before the blow-pipe, it fuses only in thin splinters. In borax, it is very slowly dissolved. It gelatinizes in heated muriatic acid.

2. *Analysis.*

	By Fuchs.	By Kobell.
Alumina	24·80	21·4
Silica	29·64	31·0
Lime	35·30	37·4
Oxide of iron	6·56	4·4
Magnesia	0·00	3·4
Water	3·30	2·0

3. It has been found on Mount Monzoni, in the valley of Fassa in the Tyrol, along with Calcareous Spar.

GIBBSITE. Staphyline Wavelline-Spar.

Irregular stalactites; tuberose masses.

Structure fibrous, the fibres radiating from the centre.

Lustre faint. Color greenish or greyish white. Translucent.

Hardness =3·0 . . . 3·5, but easily reduced to powder. Sp. gr. =2·4.

1. Before the blow-pipe, it whitens, but is infusible.

2. *Analysis.*

	By Torrey.
Alumina	64·8
Water	34·7

3. It is found in very small quantity only, disseminated through a bed of Limonite, at Richmond, (Mass.)

GIESECKITE.

Crystallized in six-sided prisms.

Cleavage not visible. Fracture uneven, splintery.

Lustre resinous, faint. Color olive-green, grey, brown.

Streak uncolored. Feebly translucent on the edges ... opake.

Hardness = 2·5 ... 3·0. Sp. gr. = 2·832.

1. *Analysis.*

By STROMEYER.

Silica	46·07
Alumina	33·82
Magnesia	1·20
Black oxide of iron	3·35
Oxide of manganese	1·15
Potash	6·20
Water	4·88

2. It occurs in Greenland, with Feldspar.

3. The above description probably applies to a variety of Mica, similar to Pinite.

GILBERTITE.

Massive; foliated.

Lustre pearly. Color white, with a shade of yellow. Translucent.

Sectile. Hardness = 4·00? Sp. gr. = 2·648.

1. *Analysis.*

By THOMSON.

Silica	45·155
Alumina	40·110
Lime	4·170
Magnesia	1·900
Protoxide of iron	2·430
Water	4·250

2. It occurs at St. Austle in Cornwall, and contains through its mass particles of Fluor, and what appears to be Apatite.

3. It is quite probable, that the above mineral, which is well known as Cornish Talc, is an aggregate of Talc, Mica and several other mineral species.

GIOBERTITE. (See *Magnesite*.)

GISMONDIN. Abrazitic Kouphone-Spar.

Primary form. Right square prism.

Secondary form. Primary form surmounted by four-sided pyramids, whose faces correspond to the prismatic faces. The adjoining faces of either pyramid incline under 122° 58′: and a face of the upper pyramid to a corresponding one of the lower, under 85° 40′.

Cleavage imperfect, parallel to the pyramidal faces. Surface, prismatic faces frequently rounded; the pyramidal ones smooth, and though generally very small, yet possessing high degrees of lustre. Fracture conchoidal.

Lustre adamantine. Color pale smalt-blue, milk-white, pearl-grey and rose-red. Translucent, in small crystals, nearly transparent.

Hardness =6·0...6·5. Sp. gr. =2·16...2·2.

1. Before the blow-pipe, it phosphoresces, and becomes friable, but is infusible. It gelatinizes with acids without effervescence.

2. *Analysis.*

By Carpi.

Silica	41·4
Lime	48·6
Alumina	2·5
Magnesia	1·5
Oxide of iron	2·5

3. Gismondin occurs along with white octahedrons of Fluor, Feldspar and other minerals, in the drusy cavities of a volcanic rock, at Capo di Bove, near Rome.

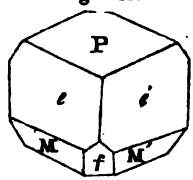
It approaches in several of its properties, especially that of form, the species Zircon.

GLAUBERITE. Prismatic Brithyne-Salt. Mohs.

Primary form. Oblique rhombic prism. M on M′=83° 20′. M on P =104° 15′.

Secondary form.

Fig. 213.



P on *e* or *e'*	137° 9′	Pillars	M on *e*	147° 40′
e on *e'*	116 20		P on *f*	112 20
M or M′ on *f*	131 35		*e* or *e'* on *f*	132 37

The planes M and *f* are often wholly wanting.

Cleavage, parallel with M and M′ perfect; traces of P but interrupted by conchoidal fracture. Fracture conchoidal. Surface, planes *e* streaked parallel to their common edges of combination, partly uneven, but smooth and shining.

Lustre vitreous. Color yellowish or greyish-white. Streak white. Semi-transparent . . . translucent.

Brittle. Hardness = 2·5 . . . 3·0. Sp. gr. = 2·807.

Taste feebly saline and astringent.

1. Before the blow-pipe, it decrepitates, and melts into a white enamel. Immersed in water, it loses its transparency, and is partly dissolved. The same appears in a moist atmosphere.

2. *Analysis.*

By Brongniart.

Sulphate of lime	49·0
Sulphate of soda	51·0

3. It occurs in imbedded crystals in Common Salt, at Villarubia, near Ocana in New Castile. Another locality is Aussee in Upper Austria.

GLAUBER SALT. Prismatic Glauber-Salt. Mohs.

Efflorescent, and in mealy crusts.

Glauber Salt.

Lustre vitreous. Color white. Streak white. Transparent to opake.

Sectile. Hardness = 1·5 . . . 2·0. Sp. gr. = 1·481. Taste cool, then feebly saline and bitter.

1. It is easily soluble in water, but readily falls into powder on being exposed to the air.

2. *Analysis.*

By Reuss.

Sulphate	of soda	67·024
Carbonate	of soda	16·333
Muriate	of soda	11·000
Muriate of lime		5·643

3. Glauber Salt is found accompanying Common Salt and Epsom Salt, or as an efflorescence, upon the soil, and on several rocks; also on the shores of salt lakes, and in some mineral springs.

4. It occurs in the neighborhood of Ausser, Ischel, and Hallstadt in Austria, at Hallein in Salzburg, in Hungary, in Switzerland; also in Italy and Spain, and the Sandwich Islands.

Glaucolite.

Massive. Cleavage parallel with a rhombic prism of 148° 30′, nearly. Fracture splintery, or uneven.

Lustre vitreous. Color lavender-blue, to green. Translucent. Hardness = 5·5. Sp. gr. = 2·7 . . . 2·9.

1. Fusible with difficulty before the blow-pipe, into a blebby white glass; but is soluble in borax and salt of phosphorus.

2. *Analysis.*

By Bergmann.

Silica . . . . . ,	54·58
Alumina . . . . . ,	29·77
Lime . . . . . ,	11·08
Potash . . . . . ,	4·57

3. It is found in compact Feldspar and granular limestone, with Talc, in the granitic mountains, upon the borders of the Sliudianka, which empties into lake Baikal.

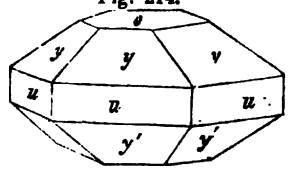
4. With the exception of the cleavage, the foregoing description would apply to some of the varieties of Scapolite.

GMELINITE. Sarcoline Kouphone-Spar.

Primary form. Rhomboid: dimensions unknown.

Secondary form. Regular hexagonal prism, with the terminal edges replaced by single planes.

Fig. 214.



y on y' - - - - 83° 36′

Cleavage parallel to the rhomboid, visible, though not easily obtained. Fracture uneven. Surface streaked, the prism horizontally, the pyramidal planes parallel to the edges of combination with the rhomboid.

Lustre vitreous. Color white, passing into flesh-red. Streak white. Translucent.

Hardness =4·5. Sp. gr. =2·05.

1. Before the blow-pipe, it swells up, and assumes the appearance of an enamel. When held in the flame of a candle, it exfoliates into numerous scales.

2. *Analysis.*

	By Vauquelin, fr. Montecchio-Maggiore.	By Vauquelin, fr. Castel.	By Thomson, fr. Antrim, Ireland.
Silica	50·00	50·00	39·896
Alumina	20·00	20·00	12·968
Lime	4·50	4·25	0·000
Soda	4·50	4·25	0·000
Water	21·00	20·00	29·866
Protoxide of iron	0·00	0·00	7·443
Potash	0.00	0·00	9·827

3. It is found in the cavities of amygdaloidal rocks, at Montecchio-Maggiore, and at Castel in the Vicentine, and in the county of Antrim in Ireland.

4. It would appear that the newly proposed *Ledererite*, from Cape Blomidon, Nova Scotia, is a variety of Gmelinite. It is described by Mr. JACKSON as occurring in regular six-sided prisms, whose terminal edges are truncated, the truncating planes inclining to the prismatic faces under angles of 180°, i. e. *y* on *y'* (of the above figure) = 80°; a difference not very considerable, when it is considered that the common goniometer was employed. The crystals, besides, are mentioned as having the longitudinal striæ upon the prismatic faces. Sp. gr. = 2·169. Hardness nearly the same as Feldspar, though from the circumstance that Mr. BROOKE considered the mineral as Apatite, it seems probable that it must be somewhat lower. The crystals are transparent, or only translucent; white, or tinged with flesh-red. Lustre vitreous. According to Mr. HAYES, it consists of, Silica 49·470, Alumina 21·480, Lime 11·480, Soda 3 940, Phosphoric acid 8·480, Oxide of iron 0·140, Foreign matter 0·030, Water 8·580, Loss 1·400. This mineral occurs in trap, with Analcime and Stilbite.

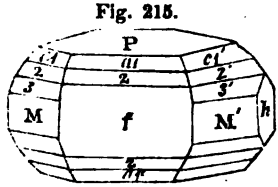
GŒTHITE. (See *Limonite*.)

GRAPHIC GOLD. Prismatic Antimony-Glance. MOHS.

Primary form. Right rhombic prism. M on M = 107° 44′.

Secondary form.

Fig. 215.



P on *a*1	141°	30′	PHILLIPS.	P on *c*3 or *c*3′	132°	45′
P on *a*2	129	12		M on *h*	126	08
P on *c*1 or *c*1′	151	40		*f* on *h*	90	00
P on *c*2 or *c*2′	136	42				

Cleavage parallel with M highly perfect; with T perfect, though not so easily obtained. Fracture uneven.

Graphic Gold.

Secondary surfaces of the prism vertically streaked; M fused-like; the remaining faces smooth.

Lustre metallic. Color pure steel-grey. Streak unchanged.

Very sectile. Hardness = 1·5 . . . 2·0. Sp. gr. = 5·723.

Compound Varieties. Regular composition of acicular crystals, nearly at angles of 60° and 120°, in one plane, frequently repeated, and imparting to the whole the appearance of certain characters for writing. Massive: composition imperfectly columnar or granular, small, but not impalpable.

1. The present species presents a great many varieties of crystalline forms, which being generally very much engaged among each other, and moreover modified by regular composition, have not yet been satisfactorily developed.

Before the blow-pipe, it melts easily into a dark grey metallic globule, and covers the charcoal with a white oxide, which changes into a green, or bluish green, when the reduction flame is directed upon it. After having continued the blast for some time, a ductile metallic metal, of a light yellow color, remains.

2. *Analysis.*

By Klaproth.

Tellurium - - - -	60·00
Gold - - - -	30·00
Silver - - - -	10·00

It yet remains to be explained how an amalgam of the above composition should possess a sp. gr. of only 5·723, when the artificial preparation would mount as high as 10.

3. Graphic Gold occurs at Offenbanya in Transylvania, in very narrow, but quite regular veins, which traverse porphyry, several of them at a short distance from each other, and parallel. It is accompanied by Native Gold and Quartz; and is occasionally met with along with Black Tellurium, at Nagyag in Transylvania.

4. It is a valuable ore, on account of its richness in gold and silver.

Graphite. (See *Plumbago*.)

GREEN EARTH. (See *Talc.*)

GREEN IRON-ORE.

Massive: reniform and fibrous.

Lustre vitreous, silky. Feebly translucent upon the edges. Color dark lake-green; the decomposed fibres, yellowish or brownish.

1. It yields water on being heated, and melts very easily into a black porous slag, which is not magnetic. It is soluble in muriatic acid.

2. *Analysis.*

By KARSTEN.

Phosphoric acid - - - -	28·50
Oxide of iron - - - -	62·52
Water - - - -	8 98

3. It occurs in the Hollester mines near Siegen, in Prussia.

GREEN LEAD-ORE. (See *Pyromorphite.*)

GREEN MALACHITE. Habroneme Copper-Baryte.

Primary form. Oblique rhombic prism. M on M′ = 103° 42′. P on the obtuse edge of the prism = 118° 11′.

Secondary form. The primary, having the obtuse edge of the prism truncated.

Cleavage, highly perfect in the direction of P; that parallel with the obtuse edge of the prism, or longer diagonal, less distinct. Fracture conchoidal, uneven, scarcely observable in crystallized varieties. The secondary plane upon the obtuse edge sometimes streaked, the other faces smooth.

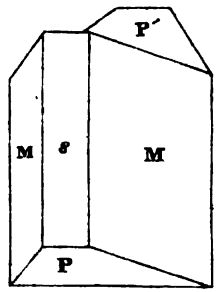
Lustre adamantine, inclining to vitreous. Color grass-green, emerald-green, verdigris-green. Streak green, rather paler than the color. Translucent, sometimes only on the edges.

Brittle. Hardness = 3·5 . . . 4·0. Sp. gr. = 4·008.

Green Malachite.

Compound Varieties. Twin-crystals: axis of revolution perpendicular, face of composition parallel with the longer diagonal of the prism; angle of revolution = 180°.

Fig. 216.



This composition occurs in almost every variety, and even in those masses which consist of columnar particles of composition. It then seems as if both the faces of a prism were present, forming a dihedral termination of each individual of 123° 37, while in fact there exists only one of them. Fascicular aggregations of delicate crystals. Tuberose, globular, reniform, botryoidal and stalactitic shapes: surface drusy, rough, sometimes smooth; composition columnar, generally very thin, often impalpable. Very thin columnar composition, produces a satiny lustre; impalpable composition, is the cause of conchoidal fracture. Massive: composition as above. The composition often repeated; granularly compound masses consist of columnar ones radiating from a centre; curved lamellar ones are likewise composed of thin columnar indiviuals. The surface of the second composition is often rough, and particularly in curved lamellar compositions, covered with a white coating.

1. Before the blow-pipe, it decrepitates, becomes black, and is partly infusible, partly converted into a black scoria. It is easily soluble in bo-

rax, imparting to it a deep green color, and yielding a globule of metallic copper. It is soluble, without residue, in nitric acid.

2. *Analysis.*

	By KLAPROTH.	By VAUQUELIN.
Copper	58·00	56·10
Oxygen	12·50	14·00
Carbonic acid	18·00	21·25
Water	11·50	8·75

3. It occurs in the same repositories as Blue Malachite, with which it is frequently associated. Beautiful varieties of Green Malachite are found at Chessy in France, in Siberia, and at Moldavia in the Bannat of Temeswar. The compact Malachite is chiefly found at Schwatz in Tyrol. Green Malachite occurs in Cornwall, Cumberland and Wales, England.

It is found in the United States, at several places, though no where in very handsome specimens. The most interesting localities are in Maryland, in the Blue Ridge in Pennsylvania near Nicholson's Gap, and at the Perkiomen Lead Mine, and in New Jersey at Schuyler's mines, where it is accompanied by Red Copper-Ore.

4. Those varieties which are sufficiently compact, are cut into vases, snuff boxes, ring-stones and other ornaments. Others are used as pigments. If it occurs in sufficient quantity, it is a valuable ore for the extraction of copper.

GREY ANTIMONY. Prismatoidal Antimony-Glance. MOHS.

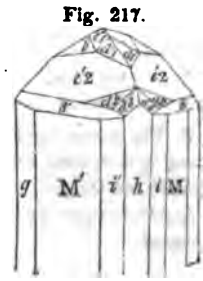
Primary form. Right rhombic prism. M on M = 91° 10′. (90° 45′. MOHS.)

Secondary form.

M′ on M	88°	40′
M′ on *e*′2, or M on *e*2	145	30
M′ or M on *h*	134	20
M′ on *i*′ or M on *i*	171	40
M′ on *g*	173	00
e′2 on *e*2	108	30
h on *e*′2 or *e*2	125	30
h on *i*′ or *i*	161	30

PHILLIPS.

Fig. 217.



Grey Antimony.

Cleavage, highly perfect in the direction of *h*, or the shorter diagonal of the prism; much less distinct parallel with M. Fracture small conchoidal, rather imperfect. Surface, the vertical planes deeply striated parallel to their own intersections, and rough. The remaining faces generally smooth. Subject to tarnish.

Lustre metallic. Color lead-grey, inclining to steel-grey. Streak unchanged.

Sectile. Thin laminæ are a little flexible. Crystals sometimes bent. Hardness =2·0. Sp. gr. =4·62.

Compound Varieties. Massive; composition columnar, of various sizes of individuals, sometimes very thin, but not impalpable. They are long and straight, either parallel or divergent from several common centres, and aggregated in a second angulo-granular composition. The faces of composition are irregularly streaked in a longitudinal direction. Sometimes the composition is granular, and then the individuals often become impalpable, but are generally very strongly connected; the fracture becomes even or uneven. Capillary crystals often form a tissue resembling wool, or felt.

1. Grey Antimony is very fusible before the blow-pipe, and is absorbed by the charcoal. By a continued blast, it may be valatilized, without leaving any considerable residue.

2. *Analysis.*

	By Proust.	By Thomson.
Antimony	75·00	73·77
Sulphur	25·00	26·23

3. The present species occurs in veins and beds: in the latter case along with Spathic Iron. It is frequently associated with Heavy-Spar, Blende and Quartz. Its decomposition produces the *Antimony-Ochre*, a friable, compact yellow substance, with which it is often associated or covered.

4. Veins, consisting almost entirely of the present species, have been discovered at Pösing near Pressburg in Hungary, and at Wolfsthal in the county of Stollberg in the Hartz; also such as contain considerable quantities of it associated with other minerals, at Felsobanya in Upper Hungary, at Cremnitz, Schemnitz, and other places in Lower Hungary, and in France. Other localities are Bräunsdorf near Freiberg in Saxony, Neudorf in Anhalt, Cornwall and Scotland. The fibrous variety occurs at Loben in the valley of the Levant in Carinthia, and the compact at Magurka in Hungary.

5. It is used for extracting the crude antimony, or the metal itsef, which is employed in the manufacture of several metallic alloys, and in medicine.

Appendix to Grey Antimony.

1. *Haidingerite.* Berthier.

Massive; sometimes exhibiting appearances of prismatic crystals, but generally in confusedly aggregated masses, whose structure is foliated.

Lustre feeble, metallic. Color iron-grey, with tarnished hues.

1. Before the blow-pipe, it melts readily. It is quickly acted upon by cold muriatic acid, giving out pure sulphuretted hydrogen; and is totally dissolved except some Pyrites and Quartz.

2. *Analysis.*

By Berthier.

Sulphur	30·8
Antimony	52·0
Iron	16·0
Zinc	0·3

3. It occurs along with Quartz, Calcareous Spar and Iron-Pyrites, at Chazelles in France.

4. It has until lately been rejected as an ore of antimony, on account of the impurity of the metal obtained.

5. It is probable that this mineral is nothing more than an impure variety of Grey Antimony.

Grey Manganese. (See *Pyrolusite*, *Manganite* and *Psilomelan*.)

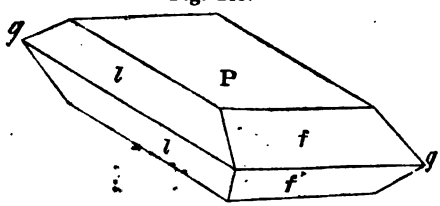
Gurhofian. (See *Dolomite*.)

GYPSUM. Prismatoidal Gypsum-Mica.

Primary form. Right oblique angled prism. M on T =113° 8′.

Secondary forms.

Fig. 218.



Oxford, England—Ohio.

Fig. 219.

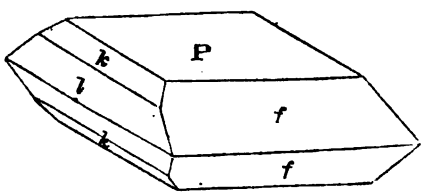


Fig. 220.

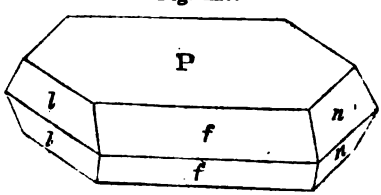
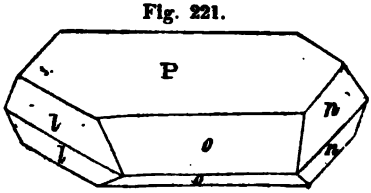
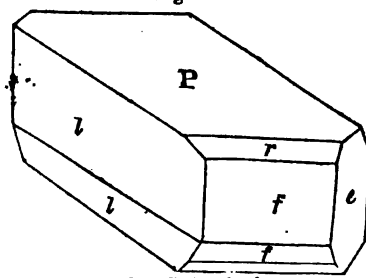


Fig. 221.



Gypsum.

Fig. 222.



Bex, Switzerland.

Fig. 218. Primary form, having the longer and shorter terminal edges replaced. P on $l = 108° 3' 19''$. P on $f = 124° 41' 43''$. f on $f = 110° 36' 34''$. l on $l = 143° 53' 22''$. (*trapezienne.* HAUY.)—Fig. 219. The same, altered only through the additional planes k. P on $k = 134° 21' 40''$. k on $l = 153° 41' 39''$. (*progressive.* HAUY.)—Fig. 220. The same as Fig. 218, with the addition of planes n through the replacement of the acute terminal angles. (*équivalente.* HAUY.)—Fig. 221. The same with Fig. 220. excepting the substitution of planes o for f. o on $o = 71° 40' 32''$. (*quaterno bisunitaire.* HAUY.)—Fig. 222. Like Fig. 218. with the addition of planes r, and the truncation of the acute, lateral edges. (*disjointé.* HAUY.)

Cleavage, parallel with P highly perfect, and easily obtained; with M and T imperfect, the former of these being of a conchoidal appearance, while the former is obtained with difficulty, on account of the flexibility of the mineral in that direction, and often presents a fibrous aspect. Fracture scarcely perceptible.

Surface. P and l streaked, parallel to their common intersections. The faces e and f often rounded, which

gives rise to the well known lenticular shapes, if the faces P and *l* disappear.

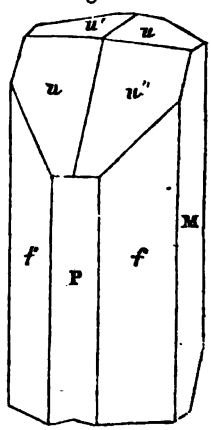
Lustre vitreous. P possesses a pearly lustre, more or less distinct, both upon faces of cleavage and faces of crystallization.

Color, generally white, sometimes inclining and passing into smalt-blue, flesh-red, ochre-yellow, honey-yellow, and several shades of grey. Impure varieties assume dark-grey, brick-red and brownish-red tinges. Streak white. Transparent . . . translucent.

Sectile. Thin laminæ are flexible in the direction of those edges which arise from the intersection of P with *r*.

Hardness $=1{\cdot}5 \ldots 2{\cdot}0$. The lowest degrees upon P, its highest degrees in the direction in which the crystals are rounded. Sp. gr. $=2{\cdot}310$.

Fig. 223.



Compound Varieties. Twin-crystals. 1. Axis of revolution perpendicular, face of composition parallel to M. Angle of revolution $=180°$, (as in the annexed figure,) which is understood, if we suppose fig. 220. to possess, instead of the edge from the meeting of *f f*, a portion of M, and the bisection to take place through P.

2. Axis of revolution perpendicular to M; face of composition parallel to P: angle of revolution $=180°$.

Gypsum.

3. Axis of revolution perpendicular; face of composition parallel to T. According to this law are formed the arrow-shaped twins, consisting of lenticular crystals. Globular masses, generally formed of discernible individuals. Dentiform. Massive: composition granular, passing into impalpable, sometimes scaly; also columnar, often as thin as hair, long, generally straight and parallel. Sometimes without cohesion of the single particles, in the state of powder.

1. Before the blow-pipe, it exfoliates and melts, though with difficulty, into a white enamel, which after a short time falls into powder. In a lower degree of heat, it loses its water and becomes friable, so as to be easily reduced to an impalpable powder. If mixed with water, this powder becomes warm, and soon hardens into a solid mass.

2. *Analysis.*

By Bucholz.

Lime - - - -	33·0
Sulphuric acid - - - -	44·8
Water - - - -	21·0

3. Compound varieties of Gypsum form beds in secondary mountains, more sparingly in the older classes of rocks; and they are generally possessed of a considerable thickness. Its principal repositories are sandstones and clay, in which it is associated with limestone and Common Salt. Brine springs very often issue from the rocks in its vicinity. Simple varieties are chiefly found in clay, in salt works; also in abandoned mines and old heaps, where they are often products of recent origin.

4. Gypsum is found in almost all countries, both crystallized and massive; for example, in Mansfeld, Thuringia, Bavaria, Franconia, Swabia, Switzerland, in the Tyrol, Stiria and Austria; also Poland, Hungary and Transylvania; in England, France, Spain. Beautiful crystals are found near Oxford, at Bex in Switzerland, Hall in the Tyrol, and at Ischel; large lenticular crystals, generally twins, occur at Montmartre, near Paris. Gypsum occurs in great quantities in Nova Scotia, both the earthy varieties and the scaly. In the United States, this species is abundant in Arkansaw, Illinois, Tennessee, Virginia, Ohio and N.York. At Poland, in Trumbull co. (Ohio,) exceedingly perfect and transparent

crystals, several inches long, of the form of Fig. 218, are found. Near Niagara falls, and at Lockport, (N.Y.) very handsome varieties of snowy white, granular, and foliated Gypsum, occur imbedded in black limestone.

5. Gypsum is variously employed in manufacturing artificial marble, stucco work, mortar, &c.; also for making casts of statues, medals, &c. It is added to the mass of certain kinds of porcelain and glass. In sculpture, it is used under the name of alabaster. It is also employed in agriculture, for improving the soil, both calcined, and in its natural state; it forms the paste of colored drawing pencils, and is employed in polishing.

GUMMITE. (See *Halloysite.*)

HAIDINGERITE. Diatomous Gypsum-Mica.

Primary form. Right rhombic prism. M on M $=99^{\circ}$ $52'$.

Secondary forms. The primary, having the lateral and terminal angles replaced by single planes, together with the truncation of the obtuse lateral edges, and the bevelment of the lateral edges. The obtuse edges of the prism are sometimes replaced by three planes.

Cleavage, highly perfect, and easily obtained in the direction of P.

Lustre vitreous. Color white. Streak white. Transparent, in small crystals translucent. Double refraction observable through M, and the opposite face replacing the obtuse edge, making an angle of 40°.

Sectile. Thin laminæ, slightly flexible.

Hardness $=2{\cdot}0 \ldots 2{\cdot}5$. The face P may be scratched by Common Salt. Sp. gr. $= 2{\cdot}848$.

1. *Analysis.*
By TURNER.

Arseniate of lime - - -	85·681
Water - - -	14·319

2. It has been observed only upon a single specimen, whose locality is unknown, in the cabinet of Mr. FERGUSON, of Raith. The mineral

forms crystalline coats, of a somewhat botryoidal appearance, over a ferruginous Quartz, which covers a rose red variety of Diallogite, resembling that found near Freiberg. The same specimen also contained large crystals of Pharmacolite.

HAIDINGERITE of BERTHIER. (See *Grey Antimony.*)

HALLOYSITE.

Reniform and tubercular masses. Massive; composition impalpable. Fracture conchoidal.

Lustre resinous. Color pure white, or tinged with blue. Translucent on the edges. In water becomes transparent.

Sectile, may be indented by the nail, and polished with the finger.

1. *Analysis.*
By BERTHIER.

Silica - - - - -	44·94
Alumina - - - - -	39·06
Water - - - - -	16·00

It is found in masses three or four inches in diameter, among ores of iron, zinc and lead, in cavities of transition limestone, at Angleure, near Liège.

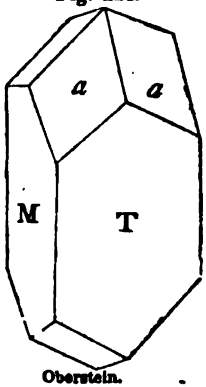
HARD COBALT PYRITES. (See *Cobaltine.*)

HARMOTOME. Paratomous Kouphone-Spar. MOHS.

Primary form. Right rectangular prism.

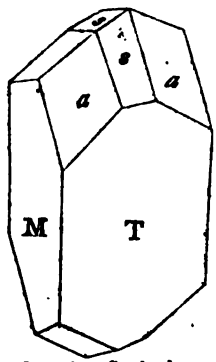
Secondary forms.

Fig. 224.



Oberstein.

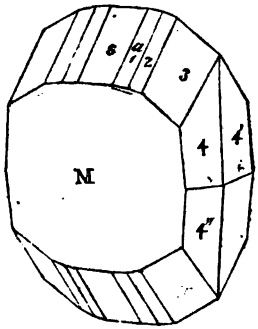
Fig. 225.



Strontian, Scotland.

Harmotome.

Fig. 226.



M on *s*	- - -	125°	5′	P.
s on *s* over the summit	-	110	26	
s on *a*1	- - -	171	4	
s on *a*2	- - -	151	35	
s on *a*3	- - -	149	32	
*a*4 on *a*4′	- - -	177	28	

Fig. 224. Primary form, with the solid angles truncated. *a* on *a* =121° 57′ 56′. *a* on *a* over the summit, =86° 36′.

Fig. 225. *s* on T = 123° 41′ 24″.

Cleavage, parallel with M and T; also with the planes *a*; but imperfect in all directions. Fracture uneven, imperfectly conchoidal. Surface, *a* and *s* streaked parallel to their common edges of combination. M and T smooth, but in most cases T is divided into four faces, meeting at very obtuse angles, as in certain varieties of Fluor.

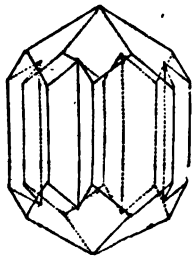
Lustre vitreous. Color white prevalent, passing into grey, yellow, red and brown. Streak white. Semi-transparent . . . translucent.

Brittle. Hardness =4·5. Sp. gr. =2·392.

Harmotome.

Compound Varieties. Twin-crystals. Face of composition parallel, axis of revolution perpendicular to one of the faces of M and T. The individuals are continued beyond the face of composition, and produce the cruciform crystals. (See annexed figure.)

Fig. 227.



Massive: composition granular, rare.

1. Alone upon charcoal, it melts, without intumescence, into a clear globule. It phosphoresces with a yellow light, and is not easily acted upon by acids.

2. *Analysis.*

	By Klaproth. fr. Andreasberg.	By Wernekink. fr. Schiffenberg.		By Thomson. fr. Strontian.
Silica	49·00	44·79	53·07	48·735
Alumina	16·00	19·28	21·31	15·100
Baryta	18·00	17·59	0·39	14·275
Lime	0·00	1·08	6·67	3·180
Potash	0·00	0·00	0·00	2·550
Ox. iron and mang.	0·00	0·85	0·56	0·000
Water	15·00	15·32	17·09	14·000

3. Harmotome occurs in metalliferous veins, traversing grey-wacke and mica-slate, and in the vesicular cavities of amygdaloidal rocks.

4. The beautiful, cruciform twins occur at Andreasberg in the Hartz; and the simple crystals at Strontian, in Scotland. Other localities are, Kongsberg in Norway, Oberstein in Deuxponts, where it is found in agate balls; Baden, near Engelhaus and Buchan in Bohemia, and in the

vicinity of Mount Vesuvius. It is also said to occur very frequently in amygdaloid, in Scotland.

HATCHETINE.

In the shape of flakes like spermaceti, or of granular masses like bees-wax.

Lustre slightly glistening and pearly, and of considerable degrees of transparency when in flakes, else dull and opake. Color yellowish-white, wax yellow and greenish-yellow.

Hardness, like soft tallow. Very light. Without odor or elasticity.

1. It melts below the boiling point of water. Ether dissolves it readily; being evaporated, the solution yields a viscid, oily inodorous matter. Distilled over the spirit-lamp, it gives a bituminous smell, a greenish-yellow, butryaceous substance is disengaged, and a coaly residue remains in the retort. At a lower temperature a light oil is distilled.

2. It occurs in small contemporaneous veins with Quartz, Calcareous Spar and iron-ores, at Merthyr Tydril in South Wales. It has been described by Mr. BRANDE under the denomination of *Mineral Adipocire.*

3. The description of Hatchetine agrees very nearly with the following one given of *Mountain Tallow.* It has the color and feel of tallow, and is tasteless; its sp. gr. = 0·6078, in its natural state, but is increased by melting it, to 0·983, the air bubbles being driven off. It melts at 118°, and boils at 290°. When melted it is transparent and colorless, but becomes opake and white on cooling. It is insoluble in water, but is dissolved by alcohol, oil of turpentine, olive-oil and naphtha, when hot, but is precipitated when they cool. It does not form soap with alcaline substances, but is combustible. It has been found in a bog, on the borders of Loch Fyne, and has been formerly noticed on the coast of Finland, in one of the Swedish lakes; near Strasburg, and in Scotland.

HAUSMANNITE. (See *Black Manganese.*)

HAUYNE. (See *Sodalite.*)

HAYDENITE. (See *Chabasie.*)

HAYTONITE.

A variety of Quartz, resembling Calcedony, in perfect crystals, single and variously aggregated, and having the form of Datholite, (variety Humboldtite.) It occurs in detached pieces, ac-

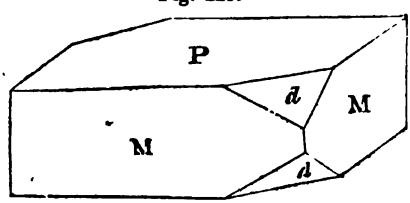
companied by small masses of Calcedony, Garnet, green Hornblende, Talc and Magnetic Iron-Ore—the aggregate being enveloped by a ferruginous clay, and existing in an iron mine adjacent to the Hay Tor granite quarries, in Devonshire. The formation of these crystals is quite inexplicable according to the known laws of pseudomorphism.

HEAVY SPAR. Prismatic Hal-Baryte. Mohs.

Primary form. Right rhombic prism. M on M′=101° 42′.

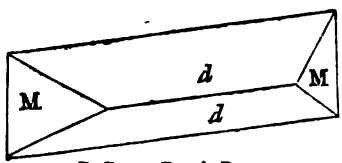
Secondary forms.

Fig. 228.



Cheshire, (Conn.)

Fig. 229.



De Roure, Puy de Dome.

Fig. 230.

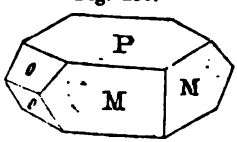
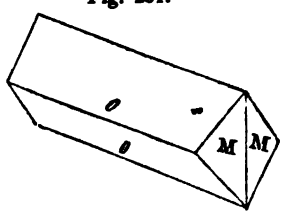
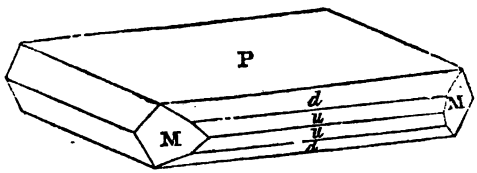


Fig. 231.



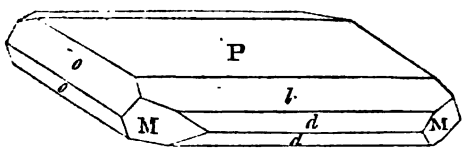
Heavy Spar.

Fig. 232.



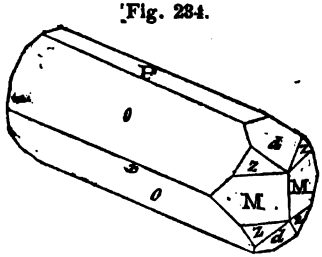
Cheshire, (Conn.)

Fig. 233.



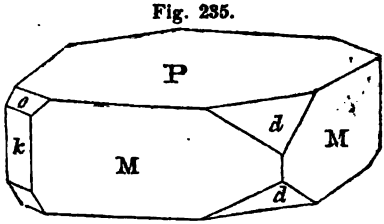
Cheshire, (Conn.)

Fig. 234.



Cheshire, (Conn.)

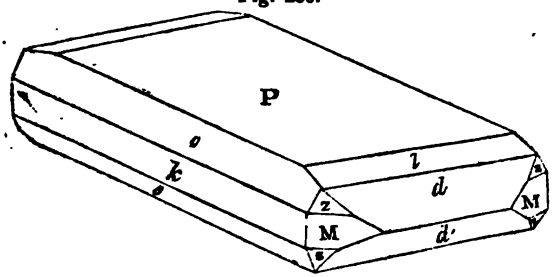
Fig. 235.



Cheshire, (Conn.)

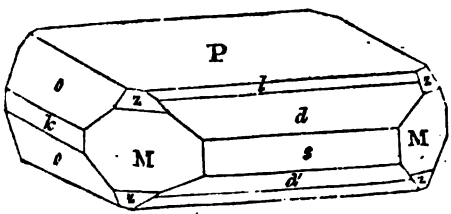
Heavy Spar.

Fig. 236.



Cheshire, (Conn.)

Fig. 237.



Cheshire, (Conn.)

Fig. 238.

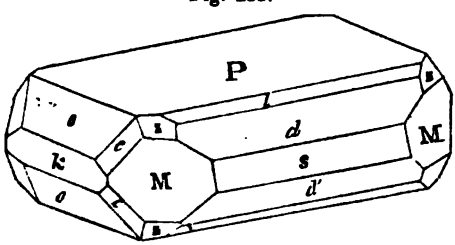


Fig. 228. Primary form, with its obtuse angles truncated. P on $d = 140° 59' 21''$. (*apophane*, H.)—Fig. 229. The same, with the faces d enlarged. d on $d = 78° 1' 58''$. (*binaire*, H.)—Fig. 230. Primary form, with its acute an-

gles truncated. P on $o=127° 5' 13''$. (*emoussée*, H.)—Fig. 231. The same, with the planes *o* enlarged. *o* on *o* $=105° 49' 34''$. (*unitaire*. H.)—Fig. 232. *d* on *u* $=160° 41' 39''$. *u* on *u* $=116° 38'$. (*bino-bisunitaire*. H.)—Fig. 233. *d* on *l* $=163° 2' 22''$. (*soussextuple*. H.)—Fig. 234. M on *z* $=154° 26' 52''$. *z* on *z* $=110° 25' 38''$. *o* on *z* $= 135° 39' 58''$. (*entourée*. H.)—Fig. 235. M on *k* $=129° 13' 54''$. *k* on *o* $=142° 8' 47''$. (*sexdecimale*. H.)—Fig. 236. (*sousquadruple*. H.)—Fig. 237. (*triplante*. H.)—Fig. 238. *c* on *o* $=166° 46' 49''$. M on *c* $=133° 31' 31''$. (*diplonome*. H.)

Cleavage. M and T perfect. The latter commonly more easily obtained, the former sometimes interrupted. Cleavages are also visible parallel with the shorter diagonal. Fracture conchoidal, seldom observable. Surface in a few examples only, faintly streaked. The same faces which in certain modifications are rough, in others are perfectly smooth, while the reverse takes place in other faces; so that they do not constantly present the same appearances.

Lustre vitreous, inclining to resinous. Color white, prevalent, inclining to yellow, grey, blue, red or brown. Streak white. Transparent . . . translucent.

Brittle. Hardness $=3·0 \ldots 3·5$. Sp. gr. $=4·446$.

Compound Varieties. Globules, both imbedded and implanted, also reniform shapes: surface drusy, uneven and rough; composition either lamellar, generally imperfect or columnar, the latter often very thin. In the reniform shapes, the curved lamellar particles of composition consist of imperfectly straight lamellar, or of columnar ones. Massive: composition as in the imitative shapes, more frequently the distinctly straight lamellar masses are aggregated

in a granular composition. The composition is sometimes granular, and even impalpable. Without coherence of the particles, friable.

1. It decrepitates when suddenly heated before the blow-pipe, and fuses with difficulty. Several varieties emit a phosphorescent light, if carefully heated, and retain this property for some time after cooling. In the interior flame, it assumes a burning, hepatic taste.

2. *Analysis.*

By Berthier.

Baryta - - - - -	66·00
Sulphuric acid - - - - -	34·00

Several varieties contain substances foreign to this mixture, which must be considered as impurities, as silica, oxide of iron, alumina, &c. Crystals of Heavy Spar have been artificially obtained by dissolving sulpho-cyanuret of barium in sulphuric acid, and allowing this solution to be slowly decomposed by the influence of the atmosphere; they are in the form of the primary; having angles of 101° 42′ and 78° 18′.

3. Many varieties of Heavy Spar, but more particularly the granular and compact ones, occur in beds, accompanying Galena and Blende; others are found in iron ores. It is frequently met with in veins, in rocks of various ages, either with the above mentioned, or with cupriferous, minerals; also with manganese ores, Grey Antimony, and Realgar.

4. Large and beautiful crystals have been found in the mines of Cumberland, Durham and Westmoreland, in England; also at Felsöbanya and Cremnitz in Hungary, at Freiberg, at Marienberg and other places in Saxony, at Pzribram and Mies in Bohemia, at Roya and Roure in Auvergne. A radiated variety, in imbedded globules, is found at Monte Paterno, near Bologna. The *Calcareous Heavy-Spar* of Breithaupt, is a variety of the present species, found near Freiberg. It contains a little sulphate of lime, in consequence of which its sp. gr. is only 4·2.

The deposits of this species are too numerous in the United States to be enumerated; only a few of the more important can be mentioned. The curved lamellar varieties are abundant at the Southampton lead mines in Massachusetts, and in several similar places in the vicinity. In Connecticut, similar varieties are found in connection with the trap and sandstone at Berlin, Farmington, and Southington. But the most interesting locality is at Cheshire, where it occurs in distinct crystals, as well

as in foliated masses, associated with crystallized Quartz, Green Malachite and Vitreous Copper, all of which minerals are imbedded in sandstone. An extremely delicate, fibrous, nearly compact variety, is found in great abundance, at Pillar Point, Jefferson co. near Sacket's Harbor, (N.Y.) where it forms large veins. Its colors are reddish-brown, and yellowish and greyish white. At the Perkiomen lead-mine in Pennsylvania, are found the foliated, the compact and the earthy varieties. Heavy Spar is extremely abundant in the Missouri lead-mines, and throughout the southern and western States generally. It occurs at Schoharie, (N. Y.) associated with Strontianite in the water-limerock.

5. Little use has heretofore been made of Heavy Spar. Pure white varieties are used as a white paint, either alone, or mixed with white lead. The fibrous variety of various colors, from Pillar Point, (N. Y.) has been sawn into moderately sized slabs, and polished; many of which present a very handsome appearance.

HEDENBERGITE. (See *Pyroxene.*)

HEDYPHANE. Hedyphanous Lead-Baryte.

Massive: composition granular and impalpable. Fracture small and imperfectly conchoidal; occasionally exhibiting little fissures.

Lustre adamantine to resinous. Color, greyish white. Translucent.

Hardness =4·5 . . . 5·0. (Scale of BREITHAUPT.) Sp. gr. =5·461 . . . 5·498.

1. Before the blow-pipe, it melts into a white frit, but less easily than the Mimetene. The lead is not reduced, even in the strongest heat of the reduction flame; nor does the resulting mass assume a polyhedral figure. The arsenical odor is rarely perceptible.

2. *Analysis.*

Oxide of lead	53·00
Muriatic acid	2.00
Lime	14·00
Arsenic acid	22·80
Phosphoric acid	8·20

Helvin.

3. It is found at Langbanshytta in Sweden, where it forms narrow veins in a beautiful red, manganesian Pyroxene, and a granular brown Garnet.

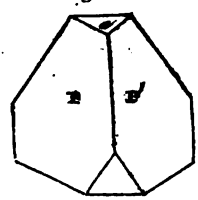
HELIOTROPE. (See *Quartz*.)

HELVIN. Tetrahedral Garnet. MOHS.

Primary form. Tetrahedron.

Secondary form.

Fig. 239.



Cleavage, traces of the octahedron. Fracture uneven. Surface, P smooth, and a little rounded, sometimes streaked parallel to the edges, *a* rough, but even.

Lustre vitreous, inclining to resinous. Color wax-yellow, inclining to honey-yellow, and yellowish brown, or to siskin-green. Streak white. Translucent on the edges.

Hardness = 6·0 . . . 6·5. Sp. gr. = 3·100.

1. Before the blow-pipe, upon charcoal, it melts in the reducing flame with effervescence into a globule, of almost the same color as the mineral. In the oxidating flame, the color becomes dark, and the fusion more difficult. With borax, it yields a transparent glass, often colored by manganese.

2. *Analysis.*

By VOGEL.

Silica	39·50
Alumina	15·65
Oxide of iron	37·75
Oxide of manganese	3·75
Lime	0·50

3. It has hitherto been found only at Schwarzenberg in Saxony, in beds in gneiss, accompanied by Blende, Quartz, Fluor and Calcareous Spar.

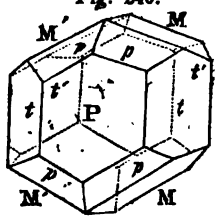
HEMATITE. (See *Limonite* and *Specular Iron.*)

HERDERITE. Prismatic Fluor-Haloide.

Primary form. Right rhombic prism. M on M′ = 115° 53′.

Secondary form.

Fig. 240.



t on *t′*	-	-	-	115°	53′
t on *t*	-	-	-	115	7
p on *p*	-	-	-	141	16

Cleavage distinct parallel to faces M, but interrupted; also perpendicular to the axis,—the latter only in detached portions of very bright and even faces; faint indications parallel to P, *p*. Fracture small conchoidal. Surface, M very smooth, and delicately streaked parallel to its edges of combination with P, and resembling in this respect the faces *p*.

Lustre vitreous, slightly inclining to resinous. Color several shades of yellowish and greenish-white: streak white, strongly translucent.

Very brittle. Hardness = 5·0. Sp. gr. = 2·985.

1. The present species has been confounded with Apatite, which it exceedingly resembles in several properties; but the different aspect of

the faces *p* and *t*, the former being smooth, or but faintly streaked parallel to their intersections with P, while the latter are granulated, proves that the forms do not belong to the hexagonal, but to the prismatic system.

2. The only specimen of Herderite at present known, is in the Wernerian museum at Freiberg. It came from the tin-mines of Ehrenfriedersdorf in Saxony.

HERRERITE. Staphyline Tellurium-Baryte.

Massive: in reniform masses.

Cleavage in three directions, affording rhomboidal fragments, whose angles are incapable of measurement on account of the curvatures of the faces.

Lustre vitreous to pearly, and shining, on fresh surfaces. Color pistachio, emerald, and grass-green. Streak yellowish grey. Translucent.

Brittle. Hardness =4·0...4·5. Sp. gr. =4·3.

1. Before the blow-pipe, on charcoal, it at first becomes grey, and afterwards gives a white smoke, which adheres to the charcoal. On directing the reduction flame of the blow-pipe upon it, it becomes of a beautiful grass-green. Heated in an open tube, it gives an abundant white smoke, which adheres to the glass, and on examining it with a microscope, it is seen to be composed of innumerable white and transparent globules.

2. *Analysis.*

By Herrera.

Carbonic acid	31·86
Tellurium	55·58
Peroxide of nickel	12·82

3. It is found at Albarradon in Mexico, in transition limestone, in a metallic vein, consisting chiefly of ores of lead, Native Silver, Horn-Silver, and Iodic-Silver.

Appendix to Herrerite.

i. *Fibrous Herrerite.* Del Rio.

Massive: reniform, composition columnar, individuals slender and radiating. Earthy and dull.

Color apple green.

Very soft; but brittle. Sp. gr. = 3.

1. It occurs with the above, and would appear to be simply a variety which has suffered partial decomposition.

HERSCHELITE.

Primary form. Regular hexagonal prism.

Secondary form. Primary, having its terminal edges replaced, the new planes inclining to the bases under 132°.

Fracture conchoidal. Surface rough. P dull and curved.

Color, white. Translucent... opake.

Hardness = 4·0...5·5? Sp. gr. = 2·11.

1. It is believed to have in general, the composition of Feldspar or Leucite.

2. It is found with Olivin, at Aci Reale in Sicily.

3. It appears to be related to Nephiline; but further researches are required to settle its specific character.

HETEROSITE. (See *Triplite.*)

HEULANDITE. Hemi-prismatic Kouphone-Spar. MOHS.

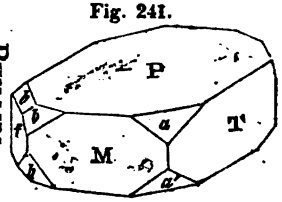
Primary form. Right oblique-angled prism. M on T = 130° 30′.

Secondary form.

M on *a*	-	146°	30′
T on *a*	-	148	00
P on *a*	-	111	56
M on *f*	-	114	20
b on *f*	-	129	40
P on *b*	-	133	35
P on b	-	108	15

PHILLIPS.

Fig. 241.



Cleavage, P highly perfect. Fracture imperfectly conchoidal, uneven. Surface of all the faces more or less uneven; P often concave, M and T convex.

Heulandite.

Lustre vitreous. The faces P possess high degrees of pearly lustre, both as faces of cleavage and of crystallization. Color, various shades of white, prevalent, passing into red, grey, and brown. Streak white. Transparent . . . translucent on the edges.

Brittle. Hardness = 3·5 . . . 4·0. Sp. gr. = 2·200. White crystals from Iceland.

Compound Varieties. Massive: composition granular, the individuals being of various sizes, sometimes easily separable, sometimes strongly cohering; faces of composition uneven and rough. Globules formed in vesicular cavities.

1. Before the blow-pipe, it melts with a slight intumescence, during which it emits a phosphoric light.

2. *Analysis.*

	By LAUGIER. Fr. the Tyrol.	By WALMSTEDT.
Alumina	10·00	7·99
Silica	45·00	59·90
Carbonate of lime	16·00	0·00
Lime	11·00	16·87
Water	12·00	13·43
Oxide of iron	4·00	0·00
Oxide of manganese	0·50	0·00

3. The varieties of Heulandite are usually found accompanied by Stilbite, in the vesicular cavities of amygdaloidal rocks, and in certain metalliferous veins.

4. Iceland and the Faroe islands afford the most magnificent crystals of Heulandite, of a pearly white color, and often transparent. A similar variety comes from the Vendyah mountains in Hindostan. The brick-red crystals and compound masses occur in the Tyrol and in Scotland.

In North America, the present species is found in great perfection in large white crystals, at Cape Blomidon in Nova Scotia. It has also been met with along with Chabasie upon mica slate, at Chester, (Mass.) and with Stilbite and Chabasie on gneiss, at Hadlyme, (Conn.)

HISINGERITE.

Massive. Cleavage distinct in only one direction. Fracture earthy.

Hopeite.

Color black. Streak greenish-grey.
Sectile. Soft. Sp. gr. = 3·045.

1. If gently heated before the blow-pipe, it becomes magnetic; in a stronger heat, it melts into a dull, opake, black globule, and yields a yellowish green glass with borax.

2. *Analysis.*

By Berzelius.

Oxide of iron . . .	51·50
Silica . . .	27·50
Alumina . . .	5·50
Oxide of manganese . . .	0·77
Volatile matter . . .	11·75
Magnesia . . .	a trace.

3. It has been found in the parish of Svärta in Südermanland, intermixed with limestone.

4. It is probable that it belongs to the species Limonite.

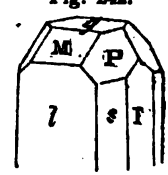
HOPEITE.

Primary form. Right rhombic prism. M on M′ = 101° 24′.

Secondary form.

s on *s* over I - -	81°	34′
M on M over *g* - -	101	24
P on P over M - -	139	41
P on P′ - -	107	2

Fig. 242.



Cleavage parallel with the longer diagonal perfect, that parallel with the base less distinct. Surface, plane I streaked lengthwise; the rest of the faces smooth.

Lustre vitreous, pearly upon *l*. Color greyish white. Streak white. Transparent . . . translucent. Refraction double.

Sectile. Hardness =2·5 . . . 3·0. Sp. gr. =2·76.

1. Before the blow-pipe, it gives off its water, and melts into a clear colorless globule, tinging the flame green. It gives no skeleton of silica with salt of phosphorus, with which it melts in all proportions. If much of the mineral is added, the globule turns opake in cooling, but does not deposit any fumes of zinc on the charcoal. The globule obtained from fusing it with borax does not become opake on cooling. With soda, it gives a scoria which is yellow when hot; copious fumes of zinc, and nearest the scoria, some of cadmium also, are deposited. The melted mineral forms a fine blue glass with solution of cobalt. Hopeite seems therefore to be a compound of some of the stronger acids, as phosphoric, or boracic acid, with zinc an earthy base, a little cadmium, and a great deal of water.

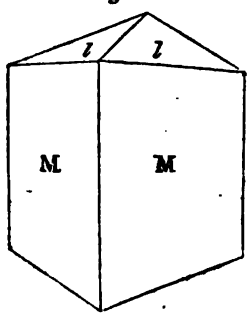
2. It has been hitherto found only in the Calamine mines of Altenberg, near Aix-la-Chapelle, and is very rare.

HORNBLENDE. Hemi-prismatic Augite-Spar. Mohs.

Primary form. Oblique rhombic prism. M on M′= 124° 30′.

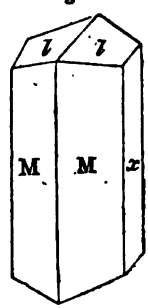
Secondary forms.

Fig. 243.



Edenville, (N.Y.)

Fig. 244.



Edenville and Amity, (N.Y.)

Hornblende.

Fig. 245.

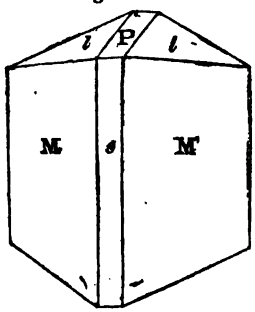
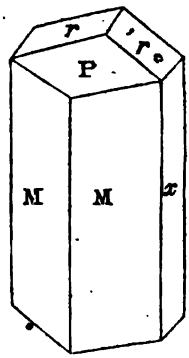
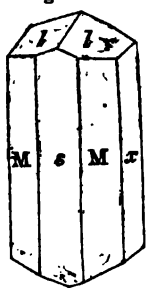


Fig. 246.



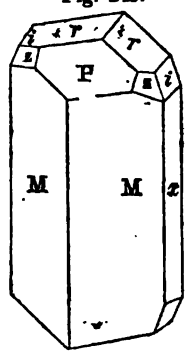
Teplitz, Bohemia.

Fig. 247.



Edenville, (N.Y.)

Fig. 248.



Willsborough, (N.Y.)

Fig. 243. Primary form, having its lateral angles truncated. l on $l = 110° 2'$. (*ditétraèdre.* H.)—Fig. 244. The same, having the acute lateral edges truncated. l on $x = 105° 11'$. M on $x = 117° 43'$. (*bisunitaire.* H.)—Fig. 245. P on $s = 104° 57'$. P on $l = 164° 49'$. M on $s = 152° 17'$. (*dihexaèdre.* H.)—Fig. 246. r on $r = 149°$

Hornblende.

38′. *r* on *x* = 105° 11′. (*dodécaèdre.* H.)—Fig. 247. (*triunitaire.* H.)—Fig. 248. *x* on *z*=118° 28′. *i* on *x* =129° 8′. (*acceléré.* H.)

Cleavage. M highly perfect; less distinct parallel with P, and to the diagonals of the prism. Fracture imperfectly conchoidal, uneven. Surface, sometimes streaked parallel to the axis; sometimes all the faces are uneven.

Lustre vitreous, inclining to pearly upon faces of cleavage in the varieties possessing pale colors. Color, various shades of green, often inclining to brown; there is an uninterrupted series into perfectly white, and into black varieties. Streak greyish-white . . . brown. Nearly transparent . . . opake.

Brittle. Hardness =5·0 . . . 6·0. Sp. gr. =3·167, basaltic Hornblende from Lower Stiria; 3·127, Carinthin; 3·036, Actynolite from Zillerthal; 3·006, blackish-green common Hornblende; 2·931, white Tremolite.

Compound Varieties. Twin-crystals: face of composition parallel, axis of revolution perpendicular to *s*, of Fig. 245. as in Fig. 250.

Fig. 249.

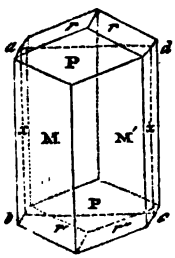
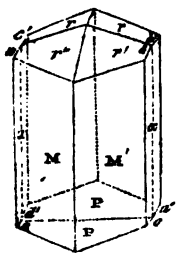


Fig. 250.



This composition is also observable in massive varieties, sometimes in very thin laminæ, having often some foreign

substance, particularly laminæ of Pyroxene, interposed between them. Massive: composition granular, individuals of various sizes, generally strongly cohering, and producing in the large, a tendency to slaty fracture; composition columnar, individuals of various sizes, sometimes very delicate, generally long, parallel, or diverging, and aggregated in a second granular composition. Compositions of short and irregularly distributed columnar particles, possess, in the large, a slaty fracture. Very thin columnar composition produces a silky lustre.

1. Of those varieties of the present species which have obtained distinct names, and which in some systems of mineralogy, have even been regarded as forming separate species, the following are the most remarkable, viz. *Hornblende, Tremolite, Actynolite* and *Asbestus*. The dark blackish and greenish colors constituted Hornblende, which was divided into *basaltic, common* and *slaty;* the first of these affording crystals easily cleavable; the second such as are of difficult cleavage, and the massive, granular and columnar varieties, excepting such as are jet-black, shining and easily cleavable, which were distinguished under the name of *Carinthin*, and the third comprehends such massive specimens as exhibit a slaty fracture. Tremolite consists of the pale green, grey, bluish and white varieties, and has been divided into *common, asbestiform* and *granular*. The first occurs in crystals, rarely with perfect terminations, and in massive varieties, in which the individuals are large; the second in columnar compositions, or coarsely fibrous, with considerable degrees of transparency; the third refers to very thin or capillary crystals; and the fourth consists of granular particles. The varieties of Actynolite differ from those of Tremolite, by their deep green, (often grass-green) colors. The asbestiform tremolite, and asbestiform actynolite, form a passage into *asbestus*, which term is applied not only to minute columnar, and variously interwoven individuals of this species, but to those also of Pyroxene and some other species,—the name denoting rather a peculiar state of aggregation in these species, than the substance of a distinct mineral.*

* Asbestus in general, has been divided into *amianthus*, which consists of highly delicate fibres, often thinner than a hair, longitudinally

Hornblende.

Green Diallage or *Smaragdite*, in some cases consists of laminæ of Hornblende, with faces of composition parallel to *s*; in others, of the same, alternating with laminæ of Pyroxene; both generally of bright green colors.

Among the varieties of this species, and those of Pyroxene, a striking analogy of certain varieties has been observed. Augite and Hornblende, Sahlite and Actynolite, Diopside and Tremolite, stand in these relations; and both series terminate in their respective kinds of asbestus.

2. Before the blow-pipe, Hornblende melts with a little difficulty, attended by a slight degree of intumescence, into a globule, which is not clear, but variously colored by iron or chrome, agreeably to the contents of the specimen. In borax, it also fuses slowly.

3. *Analysis.*

	By Bonsdorf.			By Vauquelin.
	a white var.	a green var.	a black var.	Smaragdite, fr. Corsica.
Silica	60.31	46·26	45·69	50·00
Magnesia	24·23	19.03	18·79	6·00
Lime	13·66	13·96	13·85	13·00
Alumina	0·26	11·48	12·18	11·00
Protoxide of iron	0·15	3·43	7·32	0·00
Protoxide of manganese	0·00	9·36	0·22	0·00
Fluoric acid	0·94	1·60	1·50	0·00
Oxide of iron	0·00	0·00	0·00	5·50
Oxide of copper	0·00	0·00	0·00	1·50
Oxide of chrome	0·00	0 00	0·00	7·50
Water & foreign substances	0·10	1·04	0·00	0·00

4. Imbedded crystals of basaltic Hornblende often accompany those of Pyroxene in basaltic and amygdaloidal rocks. Crystals of Hornblende and of Tremolite, are found in limestone and dolomite rocks, as well as in porphyry and granite. Common Hornblende, Actynolite, and Tre-

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cohering with each other, and easily separated; into *common* asbestus, relating to coarser varieties, more firmly cohering, and yielding splintery fragments; into *Rock-cork*, in which the particles are aggregated in a loose felt-like texture; and into *Rock-wood* or *ligneous asbestus*, in which a texture of the preceding kind, only more firm and close, assumes the appearance of dried wood.

molite, occur in metalliferous veins and beds in ancient rocks, with ores of titanium, iron, zinc and lead. Common Hornblende frequently enters into the composition of rocks, as in sienite, greenstone, &c. Actynolite is chiefly found in talcose slate. Amianthus lines the sides of narrow veins in primitive mountains.

5. Basaltic Hornblende occurs in beautiful crystals, near Teising and Teplitz in Bohemia. Large and very distinct, black crystals are found imbedded in granular limestone, at Pargas, Finland. Crystals of a handsome green color, often becoming small, and possessed of rounded edges, occur at Pargas in Finland, in white limestone; and which have been called *Pargasite*. The crystals in the drusy cavities of Vesuvian minerals, though small, are generally very distinct, and possess a high degree of lustre. Handsome varieties of Tremolite are found in dolomite at St. Gothard: Amianthus in great abundance at Corsica, also in Piedmont, Savoy, Salzburg, and Zöblitz, in Saxony. Rock-wood exists in large masses, in a metalliferous bed at Sterzing in the Tyrol: Rock-cork at Johanngeorgenstadt in Saxony, at Sahlberg in Sweden, in Moravia, and at the Lead-Hills in Scotland. Green Diallage, generally accompanied by Garnet and Saussurite, occurs at Corsica, on Monte Rosa, in the Bacher, and several other places in Southern Europe.

The United States afford the present species in all its varieties. Long black crystals, sometimes flattened through the truncation of the obtuse lateral edges, occur at Chester, (Mass.) and at Franconia, (N. H.); the latter place likewise affords brilliant black prisms, having the acute lateral edges replaced. Large and handsome black crystals (*dodécaèdre*. H.) occur at Newton, (N.J.) Small but very perfect black crystals, are found at Willsborough, (N.Y.) upon the mountain near the well known Garnet and Tabular Spar locality, where they occur imbedded in black Tourmaline. Very distinct reddish brown crystals, one or two inches long, and possessing nearly the same diameter, have been obtained along with black Spinel, at Amity, (N.Y.) Hair-brown and greenish white crystals, of unusual finish and beauty, occur in the limestone of Edenville, (N.Y.): also a light greyish white variety in limestone, from the same vicinity, associated with yellow Tourmaline and Rutile, whose crystals are often coated and penetrated by Kerolite. White crystals, above an inch long, and three quarters of an inch wide, but much flattened, abound throughout the dolomite beds of Litchfield co. (Conn.) particularly at Canaan; they are also found under similar circumstances, farther north into the borders of Mass achusetts, at Sheffield and Great Bar

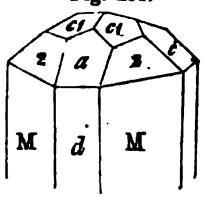
rington. Similar, though more slender forms of the same variety, occur at Antwerp, (N.Y.); at which place also is found the variety Pargasite. Handsome varieties of Actynolite are found at most of the steatite quarries in Vermont; particularly at Windham, Readsborough and New-Fane: also at Middlefield, (Mass.) Massive, granular Hornblende, in large easily cleavable individuals, of a shining black color, are found at Plymouth, (Vt.) and at Edenville, (N.Y.) Columnar and radiating varieties, of the same color, abound in Hawley, (Mass.) A green fibrous variety, the fibres several inches long, and parallel, occurs at Cumberland, (R. I.) Massive Tremolite, as well as fibrous, abounds throughout the granular limestone and dolomite of the country. The finest specimens are found in Litchfield county, (Conn.) Hornblende asbestus abounds at Staten Island, (N.Y.) at West-Farms, (Conn.) at Brighton and Dedham, (Mass.); also near Philadelphia, in Hornblende rocks. A delicate variety, in short fibres, (Byssolite,) occurs in the iron-mines of Franconia, (N. H.)

HORN QUICKSILVER. Pyramidal Pearl-Kerate. Mohs.

Primary form. Right square prism.

Secondary form.

Fig. 251.



M or M on c1, or c1	-	129° 30?
M or M on c2, or c2	-	158 00
M or M on d	-	135 00
a on d	-	119 30

Cleavage, parallel with M very indistinct. Fracture perfectly conchoidal. Surface smooth.

Horn Quicksilver—Horn Silver.

Lustre adamantine. Color yellowish grey or ash-grey, also yellowish and greyish white. Streak white. Translucent, sometimes only on the edges.

Sectile. Hardness $=1{\cdot}0\ldots2{\cdot}0$. Sp. gr. $=6{\cdot}482$.

Compound Varieties. Crystalline coats, probably formed originally upon globules of fluid mercury: composition not observable. Massive: composition granular.

1. Before the blow-pipe, upon charcoal, it is entirely volatilized, if pure. It is not soluble in water.

2. *Analysis.*

Oxide of mercury - - - - - -	88·48
Muriatic acid - - - - - -	11·52

3. This rare mineral occurs in secondary rocks, along with Cinnabar and ochry varieties of Iron-Ore.

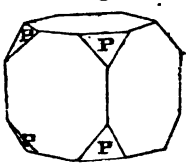
4. Its chief locality is Moschellandsberg in Deuxponts, but it also occurs at Idria in Carniola, and Almaden in Spain. At Horzowitz in Bohemia, it has been found with Cinnabar in veins, traversing a bed of Iron-Ore.

HORN SILVER. Hexahedral Pearl-Kerate. Mohs.

Primary form. Cube.

Secondary forms.

1. Fig. 252.



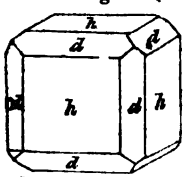
Cornwall, England.

2.

Octahedron.

Siberia.

3. Fig. 253.



Johanngeorgenstadt.

4.

Rhombic dodecahedron.

Siberia.

Horn Silver.

Cleavage none. Fracture more or less perfectly conchoidal. Surface of the cube sometimes faintly streaked parallel to the edges of combination with the dodecahedron.

Lustre resinous, passing into adamantine. Faces of fracture often more splendent than those of crystallization. Color pearl-grey, passing on the one hand into lavender-blue and violet blue, on the other, into greyish, yellowish and greenish white, into sisken-green, asparagus-green, pistachio-green, and leek-green. The color becomes brown on being exposed to light. Streak shining. Translucent... feebly translucent on the edges.

Sectile. Hardness = 1·0 ... 1·5. Sp. gr. = 5·552, a white granular variety from Peru.

Compound Varieties. In crusts: composition scarcely observable, sometimes columnar. Massive: composition granular, strongly coherent, or imperfectly columnar, and often bent; faces of composition rough.

1. It is fusible in the flame of a candle, and emits fumes of muriatic acid. Upon charcoal, it may be almost entirely reduced before the blow-pipe, and is likewise easily reduced, if rubbed wet upon a clean surface of iron or zinc. It is insoluble in nitric acid or in water. It may be obtained in a crystallized state, either from fusion, or from the evaporation of a solution of muriate of silver in ammonia.

2. *Analysis.*

By Klaproth.

	from Saxony.	from Peru.
Silver	67·75	76·0
Oxygen	4·75	7·6
Muriatic acid	14·75	16·4
Oxide of iron	6·00	0·0
Alumina	1·75	0·0
Sulphuric acid	0·25	0·0

Horn Silver.

3. Horn Silver is most frequently found in the upper parts of veins in clay slate, but occurs also in beds, generally along with other ores of silver; very often also with ochry varieties of Limonite, or with similar varieties of decomposed Iron-Pyrites. It is associated with several species of copper-ores, and with Calcareous and Heavy Spar.

4. Formerly, it occurred in considerable quantities in the Saxon mining districts of Johanngeorgenstadt and Freiberg; also at Joachimsthal in Bohemia. In small quantities, it occurs in France, in Spain, at Kongsberg in Norway, in Cornwall, and Silesia; but in large masses, frequently associated with Native Silver, in Mexico and Peru, where the green varieties of colors particularly occur.

Hornstone. (See *Quartz.*)

Humboldtine.

Massive: in plates.
Color bright yellow.
Soft, yielding to the nail. Sp. gr. = 1·3.
Acquires resinous electricity by friction.

1. On ignited charcoal it is decomposed, giving out a vegetable odor, and leaves a metallic stain, at first yellow, then black, and at last red. It is insoluble in water and alcohol.

2. *Analysis.*

By Rivero.

Protoxide of iron - - - - - - -	53·56
Oxalic acid - - - - - - -	46·14

3. It occurs imbedded in moor-coal, near Bilin in Bohemia; and is supposed by Rivero to have been produced from the decomposition of succulent plants.

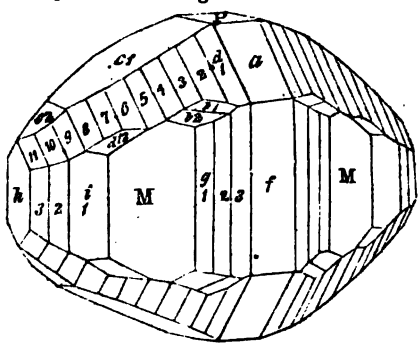
Humboldtite. (See *Datholite.*)

Humite.

Primary form. Right rhombic prism. M on M = 120°.

Humite.

Secondary form. Fig. 254.



P on *f* or *h*	90°	00′	P	*h* on *d*11	157°	20′
M on *h*	120	00		*h* on *g*3	100	40
M on *d*1	118	12		*h* on *g*2	103	40
M on *f*	150	00		*h* on *g*1	115	15
P on *c*1	144	1		*h* on *i*1	133	26
P on *c*2	153	45		*h* on *i*2	140	56
h on *a*	90	00		*h* on *i*3	143	20
h on *d*1	101	50		*c*1 on *d*1	155	2
h on *d*2	103	42		*c*1 on *d*5	159	10
h on *d*3	112	45		*c*1 on *d*7	159	30
h on *d*4	119	24		*d*1 on *g*3	116	25
h on *d*5	121	45		*d*12 on *d*8	163	22
h on *d*6	125	30		*d*12 on *g* 3	131	15
h on *d*7	129	46		*b*2 on *g*3	143	15
h on *d*8	121	20		*b*1 on M	137	00
h on *d*9	124	2		*f* on *a*	115	10
h on *d*10	136	16				

Cleavage, traces parallel to M and *h*, or to a six-sided prism.

Fracture imperfectly conchoidal.

Lustre vitreous. Color various shades of yellow, sometimes almost white, passing into reddish brown. Transparent . . . translucent.

Brittle. Hardness = 6·5 . . . 7·0.

1. Alone before the blow-pipe, it becomes opake on the outside, but is infusible. It gives a clear glass with borax.

2. It occurs at Monte Somma, with Mica and various other minerals.

3. Several of the properties of Humite would seem to render it probable that it may be identical with Brucite. At present, however, the crystalline forms of the latter substance oppose this union of the two minerals, although it must be confessed that Brucite has never been found in perfectly formed crystals.

HURAULITE.

Primary form. Oblique rhombic prism. M on M = 62° 80′. P on M = 101° 13′.

Secondary form. Primary, having its acute lateral edges replaced, and terminated by dihedral summits.

Lustre vitreous. Color yellowish-red, to reddish-brown.

Hardness = 3·5. Sp. gr. = 2·27.

1. Before the blow-pipe, it fuses very easily into a metallic, black globule, which is taken up by the magnet.

2. *Analysis.*

By DUFRESNOY.

Phosphoric acid	38·00
Protoxide of iron	11·10
Protoxide of manganese	32·85
Water	18·00

3. It is found in little masses, dispersed through graphic granite, near Limoges in France, and is accompanied by an olive green, fibrous Vivianite. The graphic granite, however, is not found in place. With the Huraulite is found a massive mineral in scales, fibres, and impalpable, which is supposed to be the same substance. The scaly variety is of an intense, reddish-brown color, and a bright pearly lustre.

HYACINTH. (See *Zircon.*)

HYALITE. (See *Opal.*)

HYALOSIDERITE.

A partially decomposed variety of Peridot.

HYDRATE OF MAGNESIA. (See *Native Magnesia.*)

HYDRARGILLITE. (See *Wapellite.*)

HYDRO-CARBON.

Primary form unknown. Crystals acicular.

Lustre pearly. Color white, or yellowish-white.

Sp. gr. = 0.65.

HYDRO-CARBONATE OF LIME.

The variety Chalk of Calcareous Spar, altered by having been subjected to the influence of trap dykes. It occurs at the Giant's Causeway in the north of Ireland. According to DA COSTA, it consists of four atoms of carbonate of lime, and three atoms of water.

HYDRO-CARBONATE OF LIME AND MAGNESIA.

A variety of Calcareous Spar or Dolomite, found in veins and irregular masses, in an amygdaloid of a loose texture, accompanied by zeolitic minerals and the common Calcareous Spar, at Derry in the north of Ireland.

HYDROGEN. Pure Hydrogen-Gas. MOHS.

Amorphous. Transparent. Expansible.

Sp. gr. = 0·0688. BERZ. 0·0732. BIOT and ARAGO. Odor peculiar.

1. Hydrogen-Gas, as it is found in nature, is generally in a state of combination. By the assistance of chemical processes, it may be obtained, free from all odor. It burns with a feeble light in atmospheric air, and if mixed with it, detonates when inflamed. It imparts neither taste nor odor to water, with which it is kept in contact.

2. Hydrogen-Gas is developed from several kinds of rocks, limestone, beds of coal, &c.; also from pools and stagnant water in general; and it is met with under these circumstances in different countries throughout the globe.

HYDROLITE. (See *Gmelinite.*)

HYDROPHANE. (See *Opal.*)

HYDROPHYLLITE. (See *Appendix.*)

HYDROSILICITE. (See *Kerolite.*)

HYPERSTHENE. Prismatoidal Schiller-Spar. MOHS.

Primary form. Obliqne rhombic prism. M on M = about 93°.

Secondary form. Primary, having the acute lateral edges bevelled. Warwick, (N.Y.)

Cleavage, parallel to the sides and base of the primary prism, more perfectly, parallel to the shorter diagonal of that form, traces parallel to the longer diagonal of the same. Fracture uneven.

Hypersthene.

Lustre eminently metallic-pearly, upon the most perfect diagonal cleavage; in other directions, more or less distinctly vitreous. Color greyish, brownish or greenish-black; several varieties almost copper-red upon the perfect face of cleavage. Streak greenish-grey. Opake; in some varieties, slightly translucent on the edges.

Brittle. Hardness =6·0. Sp. gr. =3·389.

Compound Varieties. Massive: composition granular, individuals sometimes of considerable size; faces of composition uneven and rough.

1. If heated alone, it is little altered in appearance, but melts upon charcoal into a greenish-grey, opake globule, easily soluble in borax.

2. *Analysis.*

By Klaproth.

Silica	54·25
Magnesia	14·00
Alumina	2·25
Lime	1·50
Oxide of iron	24·50
Water	1.00
Manganese	a trace.

3. Hypersthene occurs engaged in a mixture of Labradorite and Pyroxene. The rock often contains Magnetic Iron-Ore, and seems to be analogous to sienite or greenstone. It exists also in a slaty rock with Garnet, in serpentine along with Saussurite, and in white limestone along with Spinel and Brucite.

4. It was first brought from the coast of Labrador. It is quoted from Cornwall, England, where it is said to occur in serpentine, and from Greenland, where it exists in primitive slate. The variety, however, from the last mentioned place, with a blue opalescence parallel to the shorter diagonal of the prism, presents two faces of cleavage inclined at an angle of about 124° 30′, and must be referred to the species Hornblende.

Hypersthene has within a few years been met with in Orange county, (N.Y.) at Warwick, in the formation of limestone, with which is associated serpentine, and which is so abundant in Spinel and Brucite. It oc-

curs here in crystals several inches long, by half an inch in diameter; but oftener in very minute prisms. In both cases, the prisms are deficient in regular, terminating planes, though they commonly have their acute lateral edges bevelled. It is associated with Brucite, and is not abundant.

HYPOCHLORITE. (See *Green Iron-Ore.*)

HYPOSKLERITE. (See *Feldspar.*)

HYPOSTILBITE.

Massive: in globules, consisting of delicate fibres, or impalpable.

Lustre feeble. Color white.

Does not scratch glass. Sp. gr. = 2·14.

1. Before the blow-pipe, it melts with difficulty upon the edges; the mass swelling and becoming rough. Soluble in the acids without forming a jelly. The solution furnishing a precipitate by oxalate of ammonia.

2. *Analysis.*

	By BEUDANT.	By DU MENIL.
Silica	54·43	52·25
Alumina	18·32	18·75
Lime	8·10	7·36
Soda	2·41	2·39
Water	18·70	18·75

3. It has been found with Stilbite and Epistilbite, in amygdaloid, from Faroe.

4. The above description is quite inadequate for the distinction of this mineral from Mesotype.

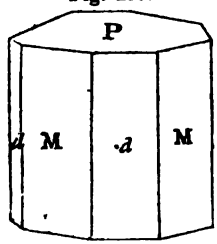
ICE-SPAR. (See FELDSPAR.)

IDOCRASE. Pyramidal Garnet. MOHS.

Primary form. Right square prism.

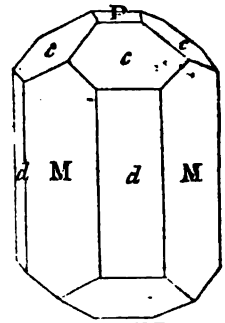
Secondary forms.

Fig. 255.



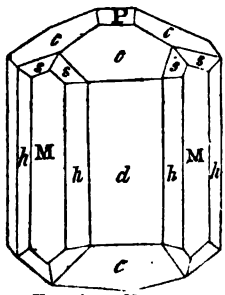
Worcester, (Mass.)

Fig. 256.



Amity, (N.Y.)

Fig. 257.



Vesuvius. Norway.

Fig. 258.

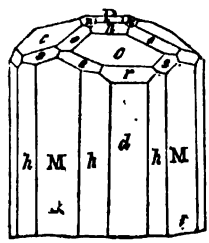
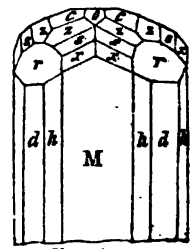


Fig. 259.



Vesuvius.

Fig. 255. Primary form, with the lateral edges truncated. M on $d=135°$. (*périoctaèdre*. H.)—Fig. 256. The same, having the terminal edges truncated. P on $c=142°$ 54′. (*unibinaire*. H.)—Fig. 257. M on $h=153°$ 27′. d on $h=161°$ 33′. s on $s=148°$ 24′. c on $s=150°$ 31′. M on $s=144°$ 44′. (*isoméride*. H.)—Fig. 258. P on $n=165°$ 51′. c on $r=145°$ 25′. d on $r=161°$ 42′. r on $s=152°$ 58′. P on $o=151°$ 52′. c on $o=154°$ 45′. M on o

Idocrase.

=118° 8′. (*encadrée.* H.)—Fig. 259. P on r=108° 18′. d on r= 161° 42′. r on z=153° 30′. r on s=152° 58′. r on x=150° 35′. x on x=154° 28′. z on z=139° 52′. (*ennéacontaèdre.* H.)

Cleavage, parallel with M not very distinct, still less so parallel with P. Fracture imperfectly conchoidal, uneven. Surface, P sometimes uneven and curved; the lateral faces striated parallel to their common intersections, the rest of the faces smooth.

Lustre vitreous, inclining to resinous, sometimes the latter very distinctly. Color various shades of brown, passing into leek-green, pistachio-green, olive-green and oil-green. Streak white. Semi-transparent... faintly translucent on the edges. If viewed in the direction of the axis, the colors incline more to yellow, perpendicular to it, more to green.

Hardness =6·5. Sp. gr.=3·399.

Compound Varieties. Massive: composition granular, of various sizes, sometimes considerable, and often strongly connected. There occur also columnar compositions, generally of thin individuals, straight and divergent or irregular, faces of composition irregularly streaked.

1. Before the blow-pipe, on charcoal, it melts easily into a pale green glass, rarely attended by effervescence. With borax, it easily melts into a clear glass stained with iron.

2. *Analysis.*

	By Klaproth.		By Borkowsky.
	fr. Vesuvius.	fr. Silesia.	fr. Eger, Bohemia.
Silica	35·50	42·00	41·00
Alumina	33·00	16·25	22·00
Lime	22·25	34·00	22·00
Magnesia	0 00	0·00	3·00
Oxide of iron	7·50	5·50	6·00
Oxide of manganese	0·25	a trace.	2·00
Potash	0·00	0·00	1·00

Idocrase.

3. Some of the varieties of Idocrase occur in serpentine, others in veins in gneiss and limestone, and in ejected volcanic masses. It is commonly associated with Garnet, Pyroxene, Mica and Hornblende.

4. The imbedded crystals of the form *unibinaire*, have been found on the banks of the Wilui river, and Lake Baikal in Siberia; the implanted, complicated crystals occur at Monte Somma, among the fragments ejected by Vesuvius, and have been originally formed in those cavities of the rock in which they are found. At Hasta, near Eger in Bohemia, it occurs in long, reddish-brown, deeply striated forms, and in columnar masses; in similar circumstances in Finland. In beds in limestone, it occurs at Orawitza in the Bannat of Temeswar, and at Mount Monzoni near Fassa in Tyrol; also near Christiania in Norway, and in magnificent crystals of a light green color, in the valley of Brozzo, and at other places in Piedmont. A variety from Tellemarken in Norway, of a blue color, and containing copper, has been called *Cyprine*.

The most interesting specimens of Idocrase which the U. S. has hitherto afforded, were discovered at Worcester, (Mass.) in a quartzose rock, in which it formed seams and veins, accompanied by Pyroxene and Garnet. The variety is precisely similar to that from near Eger in Bohemia. Another locality is at Amity, (N.Y.) where it occurs both granular and in crystals, (sometimes an inch in diameter,) disseminated through limestone with Pyroxene and Hornblende. The granular variety was supposed by Dr. THOMSON to constitute a new species, to which he gave the name of *Xanthite*. The handsome brown crystals accompanying Corundum at Newton, (N. J.) have been erroneously referred to this species: they belong to Tourmaline.

IGLOITE. (See *Arragonite*.)

ILMENITE. (See *Crichtonite*.)

ILVAITE. (See *Yenite*.)

INDIANITE.

Massive; composition granular to impalpable. It yields to cleavage, according to BROOKE, in two directions, inclined to each other under angles of 95° 15′ and 84° 45′.

Lustre vitreous. Color greyish-white, with a tinge of rose-red. Translucent.

Iodic Silver.

Hardness = 5·5 . . . 6·0. Sp. gr. = 2·72.

1. It is infusible before the blow-pipe.

2. *Analysis.*

	By Chenevix.	By Laugier.	
		white variety.	rose-red variety.
Silica	42·5	43.0	42·0
Alumina	37·5	34·5	34·0
Lime	15·0	15·6	15·0
Soda	0·0	2·6	3·3
Oxide of iron	3·0	1·0	3·2
Water	0·0	1·0	1·0

3. It occurs in the Carnatic, associated with Feldspar, Hornblende, Garnet, Corundum, Epidote and Magnetic-Iron.

4. It is nearly related to, if not identical with, Labradorite.

Indicolite. (See *Tourmaline.*)

Iodic Mercury.

In spots of a fine lemon-yellow color, in the variegated sandstone of Casas viegas, Mexico. In the air, as well as in ammonia, it changes to black. It resembles the artificial protiodide of mercury.

IODIC SILVER. Monotomous Pearl-Kerate.

Massive: in thin plates.

Color greyish white, or silver-white. Exposed to the air, it changes to lavender-blue. Lustre resinous. Streak semi-metallic. Translucent.

Soft, flexible.

1. Before the blow-pipe, on charcoal, it instantly melts, and produces a smoke which tinges the flame of a beautiful violet color, globules of silver at the same time appearing upon the charcoal.

2. It is found at Albarradon, near Mazapil in Mexico, and occurs in thin veins in steatite.

IOLITE. Prismatic Quartz. MOHS.

Primary form. Regular hexagonal prism.

Secondary forms.

1. Primary, having the terminal edges truncated.

2. The same, having all its edges, both lateral and terminal, truncated; rarely, also, its angles.

Cleavage, parallel with M, but very indistinct. Fracture conchoidal. Surface of some crystals rough and dull.

Lustre vitreous. Color various shades of blue, generally inclining to black. Streak white. Transparent... translucent; blue if viewed in the direction of the axis, yellowish-grey if perpendicular to it.

Hardness =7·0...7·5. Sp. gr. =2·583...2·718.

Compound Varieties. Massive; composition granular, strongly connected, and recognized with difficulty.

1. Before the blow-pipe, it melts in a good heat, but with difficulty, and only on its edges, into a glass not inferior to the mineral, either in color or transparency.

2. *Analysis.*

	By GMELIN.	By STROMEYER.	By Dr. BRANDES. var. Peliom, fr. Bavaria.	By BONSDORFF. var. Steinhellite, fr. Finland.
Silica	42·60	48·538	54·00	49·95
Alumina	34·40	31·730	28·50	32·28
Magnesia	5·80	11·305	0·50	10·45
Lime	1·70	0·000	0·00	0·00
Oxide of iron	1·50	5·686	16·18 peroxide	5·00
Ox. manganese	1·70	0·702	0·25	0·03

3. Iolite occurs in aggregated crystals with Garnet, Quartz, &c. at Cabo de Gata in Spain, in the bay of San Pedro; and this variety has been called *Iolite*. *Peliom* is found at Bodenmais in Bavaria, sometimes in very distinct crystals, but generally massive, with Magnetic Iron-Pyrites. It occurs with Feldspar and Garnet, in fine crystals, at Ujordlersoak in Greenland, at Arendal in Norway, and at Orijerfvi in Finland:

the variety from the last place has been called *Steinheilite*. Iolite also comes from Siberia and from Lunzenau in the Erzgebirge.

It is found in the U. S. at Haddam in Connecticut, associated with Garnet and Anthophyllite in gneiss.

4. The *Saphire d'eau* of the jewellers is a transparent variety of the present species from Ceylon.

IRIDOSMINE. Iridosmic Sclerone-Metal.

Primary form. Regular hexagonal prism.

Cleavage indistinct, and only in the direction of the bases.

In grains.

Lustre metallic. Color between silver-white and lead-grey.

Malleable with difficulty. Hardness = 6·5. Sp. gr. = 17·96 . . . 18·57.

1. It undergoes no perceptible change when heated before the blow-pipe. Heated with nitre, it affords the characteristic odor of osmium and a mass soluble in water, to which, when nitric acid is added, a green precipitate makes its appearance.

2. *Analysis.*
By Thomson.

Osmium - - - - -	24·5
Iridium - - - - -	72·9
Iron - - - - -	2·6

3. It is found with Native Platina, at Nijnotagulsk, in the Urals, and in South America.

IRON PYRITES. Hexahedral Iron-Pyrites. Mohs.

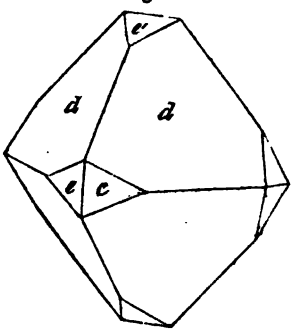
Primary form. Cube.

Secondary forms.

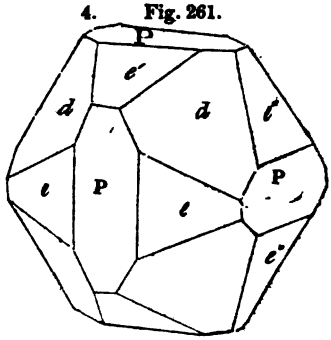
1.	2.
Cube, with angles truncated.	Regular octahedron.
Shoreham, (Vt.) Marietta, (Ohio.)	Haddam, (Conn.) Rare.

Iron Pyrites.

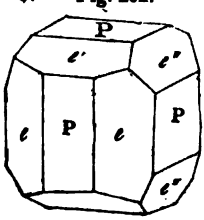
3. Fig. 260.



4. Fig. 261.

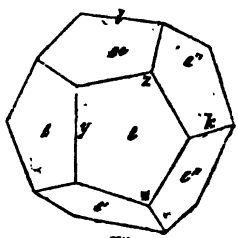


5. Fig. 262.



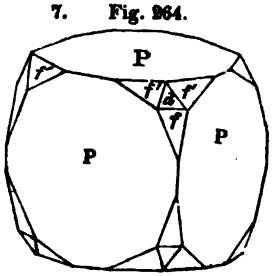
Cornwall—Elba.

6. Fig. 263.

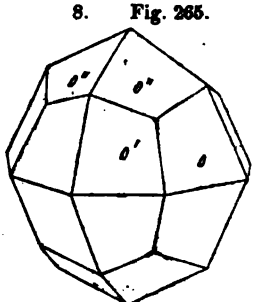


Elba.

7. Fig. 264.



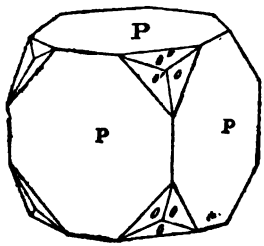
8. Fig. 265.



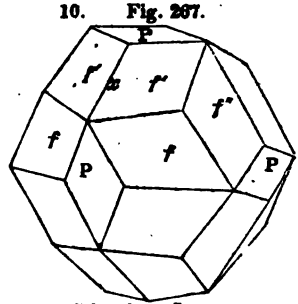
Corsica.

Iron Pyrites.

9. Fig. 266.

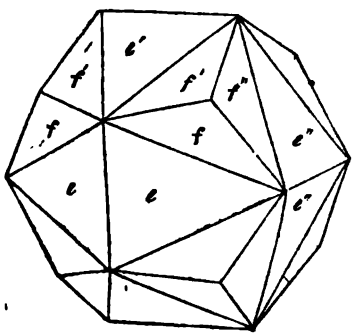


10. Fig. 267.



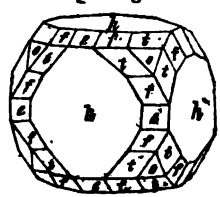
Schneeberg, Saxony.

11. Fig. 268.



Elba.

12. Fig. 269.



Valley of Planen, near Dresden.

1. (*Cubo-octaèdre.* H.)—2. (*octaèdre.* H.)—3. *e* on *e* 126° 52′ 12″. *d* on *e* = 140° 46′ 7″. (*icosaèdre.* H.)—4. P on *e*=153° 26′ 5″. (*cubo-icosaèdre.* H.)—5. (*cubo-dodecaèdre.* H.)—6. (*dodecaèdre.* H.)—7. P on *o*=144° 44′ 8″. *o* on *o*=131° 48′ 36″. (*triépointé.* H.)—8. (*trapezoidal.* H.)—9. *f* on *f*=141° 47′ 12″. *d* on *f*=157° 47′ 33″. P on *d*=152° 15′ 52″. (*quadriépointé.* H.)—10. (*triacontaèdre.* H.)—11. *f* on *e* =162° 58′ 34″. (*panto-*

gène. H.)—12. The cube, embracing all the previous modifications.

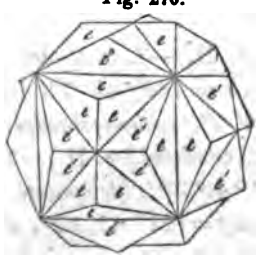
Cleavage, parallel with the cube and octahedron, in various degrees of perfection; sometimes highly perfect; often one of them more distinct, or both lost in conchoidal fracture. Fracture conchoidal, uneven. Surface of the cube streaked parallel to the obtuse edges of combination with the pentagonal dodecahedron: the faces of this dodecahedron are streaked, either parallel to the same edges, or parallel to edges which are perpendicular to the former.

Lustre metallic. Color, very few shades of a characteristic bronze-yellow. Streak brownish-black.

Brittle. Hardness = 6·0 . . . 6·5. Sp. gr. = 5·031, a cleavable variety, from Freiberg; = 4·981, a crystallized variety, from Littmittz in Bohemia.

Compound Varieties. Twin-crystals: face of composition parallel, axis of revolution perpendicular to a face of the dodecahedron. The individuals continued beyond the face of composition, by which the compound group takes a cruciform appearance. The composition frequently repeated.

Fig. 270.



Schoharie, (N.Y.)

Iron Pyrites.

Imbedded and implanted globules; surface drusy; composition indistinctly columnar. Massive; composition granular, sometimes even impalpable, strongly coherent; fracture uneven, or on a large scale, flat conchoidal. Cellular.

1. In the oxidating flame of the blow-pipe, Iron Pyrites becomes red upon charcoal, the sulphur is expelled, and oxide of iron remains. At a high temperature, in the interior flame, it melts into a globule, which continues red-hot for a short time when removed from the blast, and possesses, after cooling, a crystalline fracture and metallic appearance. In heated nitric acid, it is partly soluble, and leaves a whitish residue. Some varieties are subject to decomposition when exposed to the action of the atmosphere.

2. *Analysis.*

By HATCHETT.

Iron	47·30	47·85
Sulphur	52·70	52·15

3. Iron-Pyrites is one of the most common and widely diffused species among the ores; and occurs in very various repositories. It is engaged in imbedded crystals, and in massive nodules; the former particularly in clay-slate and greywacke-slate, the latter in greenstone, granular limestone, &c. It even forms beds by itself, included in primitive slate; and is often an important ingredient of those beds which contain ores of lead, iron, &c. It frequently occurs mixed with coal seams, and the beds of clay which form a part of the coal measures. The *Auriferous Pyrites* contains a small portion of native gold mechanically mixed with it, which appears to operate by a galvanic effect in producing the decomposition to which this variety is so generally subject. Iron-Pyrites is also found with ores of silver. It is contained in many organic remains, both of vegetable and animal origin, and is one of the species which can be distinctly traced in the composition of some of the meteoric masses.

4. Some of the crystals, along with their localities, have been mentioned above. The island of Elba is the most conspicuous for large and well defined crystals: very fine crystals are found in Piedmont, at Freiberg, Johanngeorgenstadt, &c. in Saxony, in Bohemia, in Hungary, in the Hartz, at Kongsberg in Norway, at Fahlun in Sweden, in Derbyshire and Cornwall.

The United States is not particularly rich in localities of interesting varieties of Iron-Pyrites. Shoreham, (Vt.) and Schoharie, (N. Y.) pro-

duce, in the black limestone quarry of the former place, and in the water limerock of the latter, the handsomest crystals we have yet discovered. The secondary limestones in the vicinity of Marietta, (Ohio,) afford interesting crystals.

5. Iron-Pyrites is roasted for extracting sulphur; after which it is exposed to the oxidating influence of the air for the production of sulphate of iron.

Iron Sinter.

Reniform, stalactitic . . . massive. Composition impalpable. Fracture conchoidal.

Lustre vitreous. Color yellowish-, reddish-, blackish-brown. Transparent . . . translucent on the edges.

Not very brittle. Soft. Sp. gr. = 2·40.

1. Before the blow-pipe, it intumesces, and some varieties emit a strong arsenical odor, during which they are partly volatilized.

2. *Analysis.*

	By Klaproth.	By Kersten, fr. Freiberg.	By Stromeyer.
Oxide of iron	67·00	40·45	33.46
Arsenic acid	0·00	30·25	26·06
Sulphuric acid	8·00	0·00	10·75
Protoxide of manganese	0·00	0·00	0·59
Water	25·00	28·50	28·48

3. It is found in several old mines, as Freiberg and Schneeberg in Saxony, and in Upper Silesia.

Iserine.

In small rounded grains.

Cleavage scarcely distinguishable. Fracture conchoidal.

Lustre semi-metallic. Color black. Streak black.

Hardness = 5·5. Sp. gr. = 4·68 . . . 4·78.

1. Before the blow-pipe, alone, on charcoal, it is unalterable. With the fluxes, it acts in general like Magnetic-Iron; but with the salt of phosphorus, it presents in the reduction flame a bluish-red color.

2. *Analysis.*

	By Rose, fr. Norway.	By Rose, fr. Iserweise.	By Klaproth, fr. Cornwall.	By Berthier, fr. Brazil.
Titanic acid	43·73	50·12	45·25	43·5
Peroxide of iron	42·70	49·88	51·00	54·0
Protoxide of iron	13·57			
Oxide of manganese	0 00	0·00	0·25	0·0
Silica	0·00	0·00	3·50	2·50

3. Its localities are numerous; the principal ones, however, are the banks of the Mersey near Liverpool, England, and Iserweise in the Riesengebirge.

4. Iserine possesses a strong affinity to Crichtonite in its most important properties, with which it is probable that future researches will prove it identical.

ISOPYRE.

Regular forms not observed. Massive, in very pure masses of considerable size, (nearly two inches in each direction): composition impalpable. Fracture conchoidal.

Lustre vitreous, often considerable. Color greyish black and velvet, occasionally dotted with red. Streak pale greenish grey. Opake, or very faintly translucent on the thinnest edges, with a dark, liver brown tint.

Brittle. Hardness = 5·5 . . . 6·0 Sp. gr. = 2·91.

Slight action on the magnetic needle.

1. From the description of Tachylite, (by BREITHAUPT,) it would seem that Isopyre is identical with that substance, excepting that the sp. gr. of Tachylite is only 2·5 . . . 2·54.

2. Before the blow-pipe, it fuses without the disengagement of moisture or gas; melted in salt of phosphorus, it gives indications of silica.

2. *Analysis.*
By TURNER.

Silica - - - -	47·09
Alumina - - - -	13·91
Peroxide of iron - - - -	20·07
Lime - - - -	15·43
Peroxide of copper - - -	1·94

4. Isopyre is found in the west of Cornwall.

ITTNERITE. (See *Sodalite.*)

JADE. (See *Nephrite.*)

JAMESONITE. Axótomous Antimony-Glance. MOHS.

Primary form. Right rhombic prism. M on M = 101° 20′.

Secondary forms. The primary, with its acute lateral edges truncated.

Cleavage, parallel with T highly perfect; less distinct, though easily observed, when the crystals are not too small, parallel with M and the secondary lateral planes. Fracture not observable.

Lustre metallic. Color steel-grey. Streak unchanged. Sectile. Hardness =2·0...2·5. Sp. gr. = 5·564.

Compound Varieties. Massive: composition columnar, individuals generally very delicate; straight and parallel, or divergent.

1. Before the blow-pipe, in an open tube, it yields a dense white smoke of oxide of antimony, and leaves behind chiefly antimoniate of lead. Upon charcoal, after the volatilization of the antimony and lead, there remains behind a slag, which, with the fluxes, exhibits the reaction of oxide of iron, containing traces of oxide of copper.

2. *Analysis.*

By Rose.

Sulphur	22·15	22·53
Lead	40·75	30·71
Copper	0·13	0·19
Iron	2·30	2·65
Antimony	34·40	34·90

3. It occurs in masses of considerable dimensions in Cornwall; also in Hungary.

Jeffersonite. (See *Pyroxene.*)

JOHANNITE. Cyprine Uranium-Salt.

Primary form. Oblique rhombic prism. M on M = 111°?

Cleavage, parallel with M.

Color grass-green, to siskin-green. Lustre vitreous. Streak siskin-green. Semi-transparent.

Hardness =2·0...2·5. Sp. gr. = 3·1...3·2. Taste bitter, rather than astringent.

1. It dissolves easily in water; and is a double sulphate of uranium and copper, containing water.

2. It is very rare, and has been met with only in an abandoned mine at Joachimsthal in Bohemia.

JURINITE. (See *Brookite.*)

KAKOCHLOR.

In imitative shapes, and compact. Fracture conchoidal, to uneven.

Lustre resinous. Color bluish black.

Hardness = 2·5 . . . 3·0.

1. Locality not mentioned.

KAKOXENE.

In capillary crystals, and massive, with fine columnar composition, consisting of divergent individuals.

Lustre silky. Color yellowish, to brown. Streak yellowish.

Hardness = 3·00 . . . 4·00. Sp. gr. = 3·38.

1. *Analysis.*

By STEINMANN.

Phosphoric acid	17·86
Alumina	10·01
Silica	8·90
Peroxide of iron	36·82
Lime	0·15
Water and fluoric acid	25·95

2. It is found in the fissures of a variety of Limonite, in the mines of Hrbek, near Zbirow in Bohemia.

3. It is altogether probable that this mineral is only a variety of Wavellite.

KAOLIN.

Decomposed Feldspar and Albite. q. v.

KARPHOLITE. Prismatoidal Wavelline-Spar.

Massive: composition thin columnar, scopiform and stellular, rather incoherent, meeting again in angularly granular compositions.

Lustre silky. Color high straw-yellow, sometimes approaching to wax-yellow. Opake.

Hardness =4·5 . . . 5·5. Sp. gr. = 2·935.

1. It intumesces before the blow-pipe, becomes white, and melts imperfectly into a coherent mass.

2. *Analysis.*

	By Steinmann.	By Stromeyer.
Silica	37·53	36·154
Alumina	26·48	28·669
Protoxide of manganese	17·09	19·160
Protoxide of iron	5·64	2·290
Lime	0·00	0·271
Fluoric acid	0·00	0·470
Water	11·36	10·780

3. It occurs in granite at Schlackenwald in Bohemia, accompanied by Fluor and Quartz.

Karphosiderite.

Reniform masses; rarely, also, granular. Fracture uneven.

Lustre resinous; shining and glimmering in the streak. Color straw-yellow.

Hardness = 4·0 . . . 4·5. Feels greasy. Sp. gr. = 2·5·

1. Before the blow-pipe, upon charcoal, it becomes black; and melts, in a strong fire, into a globule, which is attractable by the magnet. In glass of borax, it is easily soluble; and with salt of phosphorus, it melts into a black scoria. It contains oxide of iron, phosphoric acid, water, with small quantities of oxide of manganese and zinc.

2. It occurs in Greenland.

Karstenite. (See *Anhydrite.*)

KERASITE. Peritomous Lead-Baryte. Haidinger.

In radiated masses.

Cleavage highly perfect and easily obtained, parallel to a right rhombic prism of 102° 27′, and in the direction of its shorter diagonal. Fracture imperfectly conchoidal, to uneven.

Lustre adamantine, particularly upon the cross-fracture, inclining to pearly upon faces of cleavage. Color yellowish white, straw yellow, rose red, pale. Translucent.

Brittle. Hardness =2·5 . . . 3·0. Sp. gr. =7·077.

1. It decrepitates slightly before the blow-pipe, and is easily melted; the globule is of a deeper color than the mineral. On charcoal, it is reduced, and emits fumes of muriatic acid. Treated with peroxide of copper and salt of phosphorus, the flame assumes an intensely blue color.

2. *Analysis.*

By Berzelius.

Oxide of lead	90·13
Muriatic acid	6·84
Carbonic acid	1·03
Water	0·54

3. It is found near Church-hill, in the Mendip Hills in Somersetshire, engaged in manganese-ores, and accompanied by several other salts of lead, and by Calcareous Spar.

Keratite. (See *Quartz.*)

Keratophyllite. (See *Hornblende.*)

KEROLITE. Brittle Atelene-Picrosmine.

Primary form. Doubly oblique prism. Dimensions unknown.

Cleavage, parallel with M highly perfect, and easily obtained; less distinct parallel with T, least of all parallel with P. Fracture uneven. Surface of M streaked parallel with its combinations with P.

Lustre pearly upon M, inclining to vitreous; upon the rest, glimmering or dull. Color oil-green, siskin-green, leek-green, to blackish green, rarely presenting patches of duck-blue. Streak white. Translucent, in thin laminæ.

Sectile. Laminæ brittle. Hardness=2·5 . . . 3·0. The lowest degrees upon M: the highest upon the solid angles and edges. Sp. gr. =2·4 . . . 2·6.

Kerolite.

Compound Varieties. Massive: composition broad columnar, curved, lamellar and divergent: also botryoidal in cavities, and impalpable. Sp. gr. of the compact =2·2... 2·3. Color white, tinged by grey, green and red.

1. Before the blow-pipe, when heated suddenly, it decrepitates violently; the fragments becoming white and harder. In very small fragments, if the heat is gradually applied, a roundish enamel-like edge is produced; but unattended with any ebullition. In powder, with borax, the lighter colored varieties produce a perfectly colorless glass; the blackish green variety affords a greenish transparent glass. Pseudomorphoses in the shape of Quartz, Hornblende and Spinel.

2. *Analysis.*

	By Pfaff.	By Nuttall.	By Steel.	By Shepard.	
	var. Kerolite.	var. Marmolite, fr. Hoboken.		var. Deweylite. fr. Middlefield.	bl. gr. var. fr. Blanford.
Magnesia	18.01	46·0	41·720	40·00	41·400
Silica	37·95	36·0	41·256	40·00	40·00
Lime	0·00	2·0	0·000	0·00	0·932
Water	31·00	15·0	17·680	20·00	15·670
Protox. iron, with traces of chrome	0·00	0·5	0·000	0·00	2·700
Alumina	12·18	0·0	1·000	0·00	0·000
Peroxide of iron	0·00	0·0	0·400	0·00	0·000

3. The present species is found in veins in serpentine, and disseminated through Schiller-Spar.

4. The Kerolite was first described by Breithaupt, as occurring in reniform masses, in plates and compact, with a hardness =2·0...2·5, and sp. gr. = 2·33...2·4, having a resinous lustre, and occurring in thin seams in serpentine, at Franckenstein in Silesia. The *Marmolite* of Nuttall must be referred to the same species; it occurs at Hoboken, (N. J.) where it is found forming narrow veins in serpentine; and from whence is derived the specimens possessed of a distinctly crystalline structure. It also occurs at this place possessed of an impalpable texture, but only in small quantities. A leek green and blackish green, variety, in curved and stellular laminæ, occurs at Blandford, (Mass.) engaged in Schiller-Spar. The compact variety of the United States, and which has been called *Deweylite*, by Emmons, is found in seams and irregular veins at Middlefield, (Mass.) at Cooptown, Harford county,

(Md.) and at Amity, (N. Y.) The pseudomorphoses occur at Middlefield, (Mass.) in the shape of Quartz, of considerable dimensions, and of greyish white color; and at Amity, (N. Y.) of a bluish green and dark green color, in the shapes of Hornblende and Spinel.

APPENDIX TO KEROLITE.

i. *Dermatin.* BREITHAUPT.

Reniform, rarely globular, and in thin coatings or crusts. Fracture conchoidal.

Lustre resinous, slightly increased in the streak. Color blackish-green to leek-green, dark olive-green, and dark liver-brown. Translucent on the edges. Streak straw-yellow, or pea-yellow.

Hardness = 2·0. Sp. gr. = 2·136.

1. It has a greasy feel, and when moistened by the breath, emits an earthy smell. Before the blow-pipe, it cracks, changes to a black color, and increases in hardness.

2. It is found upon serpentine, at Waldheim in Saxony.

KILLINITE. (See *Spodumene.*)

KNEBELITE.

Massive. Fracture imperfectly conchoidal.

Lustre glistening, to dull. Color grey, spotted dirty white, red, brown and green. Opake.

Hard. Difficult to break. Sp. gr. = 3·714.

1. Alone, before the blow-pipe, it remains unaltered.

2. *Analysis.*

By DOEBEREINER.

Silica	32·5		30·32
Protoxide of iron	32·0		34·58
Protoxide of manganese	35·0		35·10

Locality unknown.

KONIGITE.

Primary form. Right rhombic prism. M on M′ = 105°.

Crystals elongated, somewhat barrel-shaped, and closely aggregated.

Cleavage parallel with P, perfect.

Color emerald and blackish-green. Translucent.

Hardness = about 2·0.

Kupaphrite.

1. It consists of sulphuric acid and oxide of copper.

2. It accompanies Red Copper-Ore, and comes from Werchetori in Siberia.

3. In chemical composition it resembles Brochantite, but this substance occurs in thin rectangular tables, whose angles are truncated, and edges bevelled, without any traces of cleavage.

KORNITE.

An impalpable variety of Quartz, (q. v.) of a dull green color, a feebly vitreous lustre, and conchoidal, or splintery fracture: with sp. gr. = 2·8 ... 2·9. It is also called *Splintery Hornstone*.

KOUPHOLITE. (See *Prehnite*.)

KROKALITE. (See *Mesotype*.)

KROKYDOLITE.

Massive.: composition columnar, particles of composition thin and parallel; impalpable, when the fracture is uneven or splintery.

Color indigo-blue.

Hardness = about 4·0. Sp. gr. = 3·200 ... 3·265.

1. Before the blow-pipe, it easily melts into a shining black glass, which is magnetic.

2. *Analysis.*

By STROMEYER.

	Fibrous variety.	Compact variety.
Silica	50·81	51·64
Protoxide of iron	33·88	34·38
Soda	7·03	7·11
Water	5·58	4·01
Magnesia	2·32	2·64
Lime	0·02	0·25

3. Its localities are Orange River, Africa, Greenland, Norway and Golling Salzburg.

KUPAPHRITE. Prismatic Euchlóre-Mica. MOHS.

Primary form. Right rhombic prism, dimensions unknown.

Secondary form. Primary, having the acute lateral edges truncated.

Kupaphrite.

Cleavage, parallel with P perfect. Fracture not observable. Surface, M deeply streaked in a horizontal direction. The rest of the faces smooth.

Lustre pearly upon P, both as faces of crystallization, and of cleavage; vitreous upon the other faces. Color pale apple-green and verdigris-green, inclining to sky-blue. Streak of the same color, only paler. Translucent, generally only on the edges.

Very sectile. Thin laminæ, flexible. Hardness = 1·0 ... 1·5. Sp. gr. = 3·098, of a crystallized variety from Schwatz.

Compound Varieties. Reniform and botryoidal shapes: surface drusy, composition columnar, faces of composition a little rough.

1. Alone, before the blow-pipe, it decrepitates very briskly, and throws around powdered fragments, which color the flame green. In the process, it immediately turns black, and melts into a steel-grey pearl, destitute of crystalline facets. On charcoal, it quietly emits moisture, without detonation; but after a longer exposure to the influence of the flame, it swells a little through the extrication of arsenical vapor. With carbonate of soda, an imperfectly fluid mass is obtained, which contains a nucleus of white metallic matter.

2. *Analysis.*

By Kobell.

From Falkenstein in the Tyrol.

Arsenic acid	25·366	25·01
Oxide of copper	43·660	43·88
Water	19·824	17·46
Carbonate of lime	11·150	13·65

3. It occurs in beds and veins, accompanied by other ores of copper, particularly by Blue Malachite.

4. The known localities of Kupaphrite are, the Bannat of Temeswar, Libethen in Hungary, Schwatz in the Tyrol, Saalfeld in Thuringia, and Matlock in Derbyshire.

KUPFERINDIG. (See *Purple Copper-Ore.*)

KUPFERSCHAUM. (See *Kupaphrite.*)

KUPHOLITE.

Massive: the individuals flat, also impalpable.

Lustre pearly. Color, yellowish white, wax-yellow, light yellowish brown. Streak white. Transparent, to translucent.

Hardness = ·5 . . . 1·00. Sp. gr. = 1·922 . . . 1·934.

1. It yields, when calcined, about 25 p. c. of water.

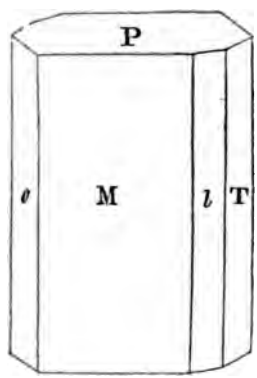
2. It occurs at Schwarzenberg, in the Erzgebirge, accompanied with the Metaxite and Kryptose Carbon-Spar of BREITHAUPT.

KYANITE. Prismatic Disthene-Spar. MOHS.

Primary form. Doubly oblique prism. P on M=93° 15′. P on T=100° 50′. M on T=106° 15′.

Secondary form.

Fig. 271.



P on *l*	97° 48′	PHILLIPS.	T on *l*	140° 55′
P on *o*	83 38		T on *o*	122 20
M on *l*	145 16			

Cleavage, parallel with M highly perfect, and easily obtained; less distinct parallel with T; least of all, parallel

with P. Fracture uneven. Surface streaked parallel to the common edges of intersection.

Lustre pearly upon M, particularly if the face is produced by cleavage; inclining to vitreous upon the other faces. Color generally white, often passing into blue, sometimes inclining to green or grey, and rarely to black. Frequently spots of berlin-blue elongated in one direction, upon a paler ground.

Streak white. Transparent... translucent.

Brittle. Hardness = 5·0 ... 7·0; the lowest degrees upon M, the highest on the solid angles and edges. Sp. gr. = 3·675, a blue, transparent variety cut and polished; 3·559, a milk white variety of Rhaetezite.

Compound Varieties. Twin-crystals: faces of composition parallel, axis of revolution perpendicular to M. Massive: composition broad columnar, sometimes straight lamellar, often curved, or divergent; faces of composition in most cases irregularly streaked.

1. Two varieties were formerly distinguished as particular species, *Kyanite* and *Rhætizite:* the former referring simply to such varieties as are blue, the latter to those whose color is white. The *Fibrolite* of Count Bournon must also coalesce with the present species, with which it perfectly agrees in every property.

2. Before the blow-pipe, Kyanite is infusible. With borax, it is soluble with great difficulty. Some crystals exhibit positive, others negative electricity, on being rubbed.

3. *Analysis.*

	By Saussure.	By Laugier.	By Klaproth.	By Chenevix. var. Fibrolite.
Alumina	54·50	55·50	55·50	58·25
Silica	30·62	38·50	43·00	38·00
Lime	2 02	0·50	0·00	0·00
Magnesia	2·30	0·00	0·00	0·00
Oxide of iron	6·00	2·75	0 50	0·75
Water	4·56	0·75	0·00	0·00
Potash	0·00	0·00	a trace	0·00

4. The varieties of Kyanite occur in crystals, or massive, imbedded in rocks of the primitive class, as gneiss and mica slate; and are often attended by Garnet and Staurotide.

5. Crystals, and large cleavable varieties, are found at St. Gothard in Switzerland, the Zillerthal in the Tyrol, the Saualpe in Carinthia, and the Bacher mountain in Stiria. The variety *Rhætizite* is chiefly known from Pfitsch in the Tyrol. The *Fibrolite* has been brought from the Carnatic and from China, where it was found in loose crystals, accompanying Corundum.

Several very interesting localities of Kyanite are known in the United States, the most important of which is that in Massachusetts, at Chesterfield, where it occurs in mica-slate, accompanied by Garnet. Nodular masses of Quartz, one or two feet in thickness, are here occasionally penetrated throughout with crystals, and cleavable masses of the present species, often of a handsome blue color. Large rolled masses, sometimes above a foot in diameter, of a similar variety, occur at Litchfield and West Farms, (Conn.) containing also Corundum and massive Apatite. The variety Fibrolite occurs in very distinct prisms, at Lancaster, (Mass.) and at Bellows Falls, (Vt.); at both places in gneiss. A black variety is found in North Carolina, in the soil, accompanied by crystals of Rutile.

6. Blue varieties of Kyanite are sometimes cut as gems.

KYMATINE.

Massive: composition columnar, individuals thin, and arranged so as to produce an undulating structure: also impalpable.

Lustre pearly. Color greenish-grey. Streak white.

Rather brittle. Hardness = 2·0 ... 3·00. Sp. gr. = 2·923 ... 2·981.

Locality not mentioned.

LABRADORITE. Polychromatic Feldspar. PARTSCH.

Primary form. Doubly oblique prism. P on M = 94° 30′. P on T = 119°. M on T = 115°.

Secondary forms. These are analogous to those of Albite, but they present less variety, and on account of their rarity in general, have been but little investigated.

Labradorite.

Cleavage parallel with P and M most distinct, that in the direction of the remaining primary face very imperfect.

Lustre, upon the cleavage planes of P pearly, passing into vitreous. Color white, passing into grey, with a tinge of blue. Opalescent and iridescent tints appear in directions not coincident with the cleavages.* Translucent on the edges.

Brittle. Hardness =6·0. Sp. gr. =2·69 . . . 2·76.

1. Before the blow-pipe, Labradorite resembles Feldspar. With oxide of nickel and borax, it affords a blue pearl. It is entirely dissolved by heated muriatic acid.

2. *Analysis.*

By KLAPROTH.

	from Labrador.	from Saxony.
Silica	55·75	51·00
Alumina	26·50	30·50
Lime	11·00	11·25
Soda	4·00	4·00
Oxide of iron	1·25	1·75
Water	0·50	1·25

3. Labradorite occurs in sienitic rocks; also as a regular constituent in several kinds of gabbro rocks, with serpentine.

4. It was first brought from the coast of Labrador. It occurs also in Ingria, in large, but ill defined crystals, in Greenland, and as a constituent of several rocks in various places of the Hartz, Saxony, near Florence, &c. The variety commonly quoted from Norway, in the zirconsienite of Friedrichsvärn, belongs to the species of Feldspar, and not to Labradorite.

Labradorite is but little known in the U. S. But one locality of any importance is known to exist in the country, which is situated at the distance of 60 miles west of Mount Moriah, upon Lake Champlain, (N.Y.) in an almost uninhabited country. It here exists in the greatest abun-

* From the researches of Dr. BREWSTER, it appears that these tints arise from the existence of empty crystallized cavities distributed through the mass.

dance, in granite, and presents the same handsome colors as the variety from Labrador. It is occasionally met with also in rolled masses, in the vicinity of Pompton plains, (N. J.) and at Amity, (N. Y.)

LANARKITE. (See *Dyoxylite.*)

LAPIS-LAZULI. (See *Sodalite.*)

LATROBITE. Eruthrone Feldspar.

Primary form. Doubly oblique prism. P on M=91° 9′. P on T = 98° 30′. M on T = 93° 30′; obtained from cleavage.

Color pale red.

Hardness = 5·75 . . . 6·50. Sp. gr. = 2·8, BROOKE. 2·72, GMELIN.

1. It fuses before the blow-pipe, in the platina forceps, into a white enamel. With borax, it yields a globule, pale amethyst red in the oxidating flame, and colorless in the reducing one. With salt of phosphorus, a globule with a silica skeleton, is obtained, yellow in the oxidating flame, and becoming opake on cooling, transparent in the reducing flame.

2. *Analysis.*

		By GMELIN.
Silica	44·653	41·780
Alumina	36·814	32·827
Lime	8·291	9·787
Oxide of manganese	3·160	5·767
Magnesia with some manganese	0·528	0·000
Potash	6·575	6·575
Water	2·041	2·041

3. It occurs in Amitok island, near the coast of Labrador, with Mica and Calcareous Spar.

END OF THE FIRST VOLUME.

TREATISE

ON

MINERALOGY:

SECOND PART,

CONSISTING OF

DESCRIPTIONS OF THE SPECIES, AND TABLES ILLUSTRATIVE OF THEIR NATURAL AND CHEMICAL AFFINITIES.

BY

CHARLES UPHAM SHEPARD, A. B.

Lecturer on Natural History in Yale College; Member of the American Geological Society; Corresponding Member of the Academy of Natural Sciences of Philadelphia; of the Natural History Society of Montreal, and of the Geological Society of France, &c.

VOLUME II.

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GENERAL DESCRIPTIONS

OF THE

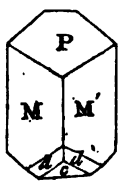
SPECIES.

LAUMONITE. Diatomous Kouphone-Spar. Mohs.

Primary form. Oblique rhombic prism: (oblique from an acute edge.) M on M′=86° 15′. M on P=113° 30′. Iceland. Nova-Scotia.

Secondary forms.

1. Fig. 272.



M on c - - 104° 20′. Phillips.

2. Primitive form, with the lateral edges truncated. Schemnitz, Hungary.

3. The same, with the addition of plane c, and the truncation of the obtuse lateral edges. Huelgoet, Brittany.

Cleavage, parallel with the shorter diagonal, distinct; traces of, parallel with the longer. Fracture uneven, scarcely observable. Surface P either smooth or uneven.

The faces parallel to the principal axis striated in that direction.

Lustre vitreous, inclining to pearly upon the more distinct faces of cleavage. Color white, passing into reddish, yellowish, or greyish tints. Streak white. Translucent.

Not very brittle. Hardness=1·5 ... 5·5. Sp. gr.=2·3.

Compound Varieties. Massive: composition granular, commonly elongated in one direction, faces of composition generally streaked.

1. Before the blow-pipe, it melts into a white spumous mass. It gelatinizes with acids, and acquires negative electricity by friction, if insulated. It is decomposed by the action of the atmosphere, and loses its water; it is therefore generally met with in a friable state, and most of its properties are on that account but imperfectly known.

2. *Analysis.*

	By Gmelin.	By Vogel.
Silica	48·30	49·00
Alumina	22·70	22·00
Lime	12·10	9·00
Water	16·00	17·50
Carbonic acid	0·00	2·50

3. It occurs in veins, traversing clay-slate with limestone: also in irregular veins and imbedded masses in porphyry, and in the cavities of amygdaloidal rocks.

4. The original locality is in the lead mines of Huelgoet in Brittany, It was next found near Schemnitz in Hungary, in porphyry. It occurs likewise on Mount St. Gothard with Apatite, in Faroe, Iceland, and various parts of Scotland, Ireland, and in Nova-Scotia.

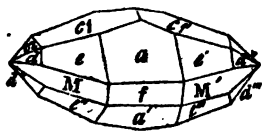
In the United States it has been met with occasionally, in small masses, in the amygdaloid of Connecticut and Massachusetts; and at Phillipstown, (N.Y.)

LAZULITE. Prismatic Azure-Spar. Mohs.

Primary form. Right rhombic prism. M on M=121° 30′.

Lazulite.

Secondary form. Fig. 272.



M on M	-	121°	30′	*a* on *e*	-	158°	10′
M on *e*	-	138	45	*c*1 on *c*1	-	120	40
M on *d*	-	140	30	*c*1 on *c*2	-	150	00
M on *f*	-	150	45	*e* on *d*	-	162	36
a on *a*	-	91	30 *	*c*1 on *e*	-	139	25
a on *c*1	-	129	10	*c*1 on *d*	-	141	20

Cleavage, parallel with *a* indistinct. Fracture uneven. Surface smooth, all the faces alike.

Lustre vitreous. Color various shades of a pure blue color, particularly deep and beautiful if viewed in the direction of one line, apparently the axis of the crystals; while perpendicular to it, it is of a pale greenish blue color. Streak white. Translucent, generally only on the edges, opake.

Brittle. Hardness = 5·0 . . . 5·5. Sp. gr. = 3·056.

Compound Varieties. Massive: composition granular, individuals strongly connected.

1. Before the blow-pipe, it intumesces a little, and assumes a glassy appearance, where the heat has been highest, but does not melt. With borax, it yields a clear colorless globule. Treated with boracic acid and a piece of iron-wire, it gives a globule of phosphuret of iron.

2. *Analysis.*

By Fuchs.

Phosphoric acid	41·81
Alumina	35·73
Magnesia	9·34
Silica	2·10
Protoxide of iron	2·64
Water	6·06

* These planes may be taken also as the primary planes.

3. It has been found in narrow veins, traversing clay-slate, both massive and crystallized with Quartz and Spathic Iron, near Werfen in Salzburg.

LEADHILLITE. Axotomous Lead-Baryte. Mohs.

Primary form. Rhomboid. P on P=72° 30′.

Secondary forms.

Fig. 274.

Fig. 275.

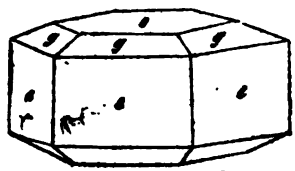
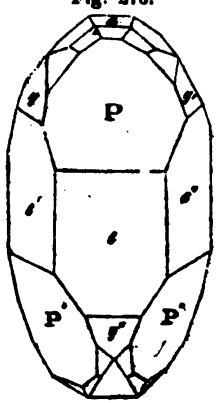


Fig. 276.



P on *a*	- - - -	111° 30′
g on *a*	- - - -	111 30
*d*1 on *a*	- - - -	131 58

Leadhillite.

Cleavage, parallel to *o*, and traces parallel to *a*. Fracture conchoidal, scarcely observable. Surface *o* very smooth and even; some of the faces curved or uneven.

Lustre resinous, inclining to adamantine, pearly upon *o*. Color yellowish white, passing into various, pale grey, green, yellow, and brown tints. Streak white. Transparent . . . translucent.

Rather sectile. Hardness =2·5. Sp. gr. =6·266.

Compound Varieties. Twin-crystals, frequent. Massive: composition lamellar, or granular.

1. Before the blow-pipe, this mineral first intumesces a little, and then becomes yellow, but re-assumes a white color on cooling. It effervesces briskly in nitric acid, and leaves a white residue.

2. *Analysis.*

By Berzelius.

Carbonate of lead	71·1
Sulphate of lead	30·0

With traces of muriatic acid, giving an excess of 1·1, probably owing to the existence of a subsalt of lead in the mineral.

3. It occurs principally at the Lead Hills of Scotland, in a vein traversing graywacke, accompanied with various other ores of lead: it has been brought from Spain under similar circumstances.

Leelite.

Massive. Fracture splintery. Lustre and translucency like horn. Sp. gr. = 2·71.

1. *Analysis.*

By Mitchell.

Silica	81·91
Alumina	6·55
Protoxide of iron	6·42
Potash	8·88

2. The specimens were brought from Gryphytta in Westmania, Sweden.

3. It scarcely admits of a doubt, that the Leelite is a variety of Feldspar.

Lenzinite.

An impure variety of Opal, in a state of partial decomposition.

LEPIDOKROKITE. (See *Limonite.*)

LEPIDOLITE. (See *Mica.*)

LEUCITE. Trapezoidal Kouphone-Spar. MOHS.

Primary form. Cube.

Secondary form. Trapezohedron. Irregular forms and grains.

Cleavage, very imperfect parallel to the primary form, and also to the faces of the rhombic dodecahedron. Fracture conchoidal. Surface of crystals even, though generally rough; of grains, uneven and smooth.

Lustre vitreous. Color reddish, yellowish, or greyish-white; ash grey or smoke grey. Streak white. Semi-transparent . . . translucent.

Brittle. Hardness = 5·5 . . . 6·0. Sp. gr. = 2·483.

Compound Varieties. Massive: composition granular; faces of composition irregularly streaked. Rare.

1. Alone before the blow-pipe, it is infusible: with borax, or carbonate of lime, it fuses with difficulty into a clear globule. Reduced to powder, it is said to change the color of the blue tincture of violets to green.

2. *Analysis.*

	By KLAPROTH.		By ARFWEDSON.
	fr. Vesuvius.	fr. Albano.	fr. Albano.
Silica	53·750	54·00	56·10
Alumina	24·625	23·00	23·10
Potash	21·350	22·00	21·15
Oxide of iron	0 000	0·00	0·90

3. It occurs chiefly in imbedded crystals and grains in lava, sometimes in compound specimens ejected by Mount Vesuvius. Besides this locality, it is also found at Albano and Frescati near Rome.

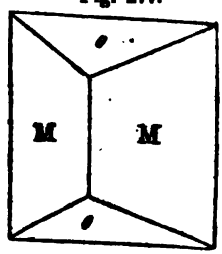
LEUCOPYRITE. Axotomous Eruthleucone-Pyrites.

Primary form. Right rhombic prism. M on M = 122° 26′.

Leucopyrite.

Secondary form.

Fig. 277.



Stiria—Bedford co. (Penn.)

o on *o*	- - - - -	51° 30′
M on *o*	- - - -	about 146 00

Cleavage, perfect parallel to the longer diagonal; less distinct parallel with two faces on the acute lateral edges, inclining under 86° 10′; traces parallel with M. Fracture uneven. Surface faintly streaked, parallel to the common edges of combination, frequently smooth.

Lustre metallic. Color between silver-white and steel-grey. Streak greyish-black.

Brittle. Hardness = 5·0 . . . 5·5. Sp. gr. = 7·228, from Silesia; 7·337, crystal from Bedford co. (Penn.)

Compound Varieties. Massive: composition granular, individuals small, often nearly impalpable, and strongly connected; fracture uneven; composition columnar, rather thick, irregular, and divergent. Faces of composition irregularly streaked.

1. It is sometimes magnetic even with polarity. It melts before the blow-pipe, without giving any perceptible smell of arsenic; but when fused in quantity beneath the flame of the compound blow-pipe, the odor of arsenic is perceptible. It is perfectly soluble in nitric acid,—a few flakes of Plumbago, only, remaining undissolved in the solution.

2. *Analysis.*

By SHEPARD.

From Bedford co. (Penn.)

Iron	97·44
Arsenic	1·56

3. It is found in beds, either along with Spathic Iron and Limonite, or imbedded in serpentine. With the first, it occurs in the valley of Löling, near Huttenberg in Carinthia; in serpentine, at Reichenstein in Silesia. It has likewise been met with in beds in primitive mountains, with Copper-Nickel and Smaltine, at Schladming in Stiria.

It has been found in the U. States at two localities, but under what circumstances, it is not known: one of them is in Bedford co. (Penn.) from whence a crystal weighing two or three ounces, was brought; and the other, in Randolph co. (N. Carolina) where a mass, weighing nearly two pounds, was obtained.

LEVYNE. Macrotypous Kouphone-Spar. PARTSCH.

Primary form. Rhomboid. P on P=79° 29′.

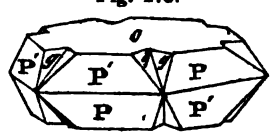
Cleavage, indistinct parallel to P. Fracture, imperfectly conchoidal.

Lustre vitreous. Color white. Streak white. Semi-transparent.

Brittle. Hardness =4·0. Sp. gr. =2·198.

Compound Varieties. Composition parallel to *o*.

Fig. 278.



o on *g* - - -	136° 1′	LEVY.
o on P - - -	117 29	

Surface *o* uneven, and generally curved.

1. In the glass tube, when heated, it gives off a considerable quantity of water, and becomes opake. Upon charcoal, it intumesces slightly.

With salt of phosphorus, it yields a transparent globule, which contains a skeleton of silica, and becomes opake on cooling.

2. *Analysis.*

	By Berzelius.	By Connel.
Silica	48·00	46·30
Alumina	20·00	22·47
Lime	8·35	9·72
Magnesia	0·40	0·00
Potash	0·41	1·26
Soda	2·75	1·55
Oxide of iron	0·00	0·77
Oxide of manganese	0·00	0·19
Water	19·30	19·51

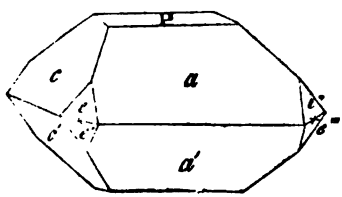
3. It occurs at Dalsnyhen in Faroe; in Ireland, and in the island of Skye, with Heulandite, in the vesicular cavities of amygdaloid.

LIBETHENITE. Diprismatic Copper-Baryte.

Primary form. Right rhombic prism. M on M=110°.

Secondary form.

Fig. 279.



x on *x*	-	110°	00′?	Phillips.
P on *c*	-	126	10	
a on *a′*	-	95	15	
c on *c*	-	121	15	
c on *e*	-	149	10	

Cleavage, parallel with P and M: the former distinct. Fracture conchoidal, uneven. Surface of P very smooth and even; M striated parallel to its edges of combination with P.

Lustre resinous. Color olive-green, generally dark. Streak olive-green. Translucent on the edges.

Brittle. Hardness = 4·0. Sp. gr. = 3·6 . . . 3·8.

1. Before the blow-pipe, on the first impression of heat, it fuses into a brownish globule, which, by further action of the heat, extends on the surface of the charcoal, and acquires a reddish grey, metallic lustre, and finally gives, at the centre, a small globule of metallic copper.

2. *Analysis.*

By Berthier.

Oxide of copper	63·9
Phosphoric acid	28·7
Water	7·4

3. It occurs engaged in cavities of Quartz, associated with Yellow Copper Pyrites, in a bed, in primitive rocks, at Libethen, near Neusohl, Hungary; also at Gunnis lake mine in Cornwall.

Lievrite. (See *Yenite.*)

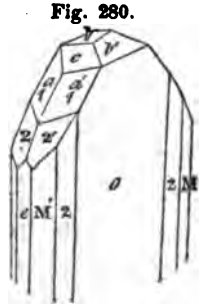
Limbilite. (See *Peridot.*)

LIMONITE. Prismatic Iron-Ore. Mohs.

Primary form. Right rhombic prism. M on M′ = 130° 40′.

Secondary form.

Fig. 280.



The crystals are compressed parallel with the shorter diagonal of the prism, so as to give an undue extension to the planes *o o* of the above figure.

Limonite.

M′ on M over *e*	130°	40′	PHILLIPS.	*c* on M′ -	120°	42′
o on *a*2′ -	135	5		*c* on *b* or *b*′ -	135	20
o on *b*′ -	121	45		*b* on *a*2 or *b*′ on *a*2′ -	121	25
o on M′ -	117	50		*a*1 on M -	129	30
a′1 on *a*1 -	125	30		*a*2 on M -	153	25
*a*2 on *a*2′ -	149	24		*a*2 or *a*2′ on *c*	147	00
b on *b*′ -	117	30				

Cleavage, pretty distinct parallel to the broad faces of the crystals, or the shorter diagonal of the prism. Surface deeply striated lengthwise of the prism.

Lustre adamantine. Color, various shades of brown; of which yellowish brown, hair-brown, clove-brown and blackish brown, are the most common. Streak yellowish brown. Crystals often semi-transparent, and showing a blood red tint. Other varieties are nearly opake.

Brittle. No action on the magnet. Hardness = 5·0... 5·5. Sp. gr. = 3·922, of a columnar, compound variety.

Compound Varieties. Globular, reniform, stalactitic and fructicose shapes: surface, of various descriptions, smooth, granulated, reniform, drusy; composition columnar, individuals very delicate, often impalpable. In the latter case, fracture becomes even, flat conchoidal, or uneven. The composition is often repeated; granular and curved lamellar masses are formed of columnar compositions, the faces of composition being either smooth, or covered with reniform asperities. Massive: composition columnar or impalpable. Sometimes the particles are so slightly coherent, that the mass appears earthy and dull. Pseudomorphoses of Calcareous Spar.

1. The present is one of those species in mineralogy, which, on account of the varieties in regard to composition, and the intermixture of other species, has been treated of under a great diversity of names, as

constituting sub-species, notwithstanding the close connexion of these varieties thus distinguished, by immediate inter-transitions. In the first place, some of what are generally regarded as pseudomorphoses, or supposititious crystals, must be excluded, because they are not real pseudomorphoses, consisting of compound varieties of this species, but are decomposed varieties of three others, viz. Iron Pyrites, White Iron Pyrites and Spathic Iron, to which they must be severally referred. The *Fibrous* Limonite, or Brown Hematite, contains the real crystals, and the compound varieties in stalactitic, reniform, and other imitative shapes; also those massive varieties in which the composition may still be ascertained. A crystallized variety, in thin laminæ, has been called *Rubinglimmer* or *Göthite*. *Compact* Brown Iron-Ore comprehends those imitative shapes and massive varieties, in which the composition is no longer observable, but which are still firmly connected; while *Ochrey* Brown Iron-Ore is applied to those which have an earthy texture, and are friable. As impure varieties of this species, or those in which other species are mechanically blended, we must consider some of the clay Iron-Ores, such as the *Granular*, the *Common*, the *Pisiform*, and the *Reniform* clay iron-ore. The granular variety is composed of compact roundish or globular masses; the reniform ore, of alternating coats of different color and consistency, disposed in a reniform surface. In the pisiform variety, we meet with a similar composition, only in small globules, parallel to the surface of which the laminæ are disposed. The compact pisiform clay iron-ore, however, does not belong to the present species, but it is a decomposed White Iron Pyrites, as is proved not only by the crystalline forms which it presents, and which are described in books, but likewise from the nucleus of undecomposed pyrites, which larger specimens of it often contain. To this species also appear to belong several scaly and nearly impalpable varieties of Iron-Ore, as the Lepidokrokite, Pyrrhosiderite, and Sideroschisolite; though it is probable that some of them contain scales of Specular Iron also.

2. Before the blow-pipe, it becomes black and magnetic. It melts with borax, into a green or yellow glass, and is soluble in heated nitro-muriatic acid.

3. *Analysis.*

By D'Aubuisson.

	A fibrous variety.	A compact variety.
Peroxide of iron	82·00	84·00
Water	14·00	11·00
Oxide of manganese	2·00	2·00
Silica	1·00	2·00

Limonite.

It is a hydrate of peroxide of iron, the proportions of peroxide of iron and water, being as 85·30 to 14·70.

4. Limonite occurs in beds and veins. When in beds, it is generally accompanied by Spathic Iron, sometimes also by Heavy Spar, Calcareous Spar, Arragonite and Quartz. These beds are included both in ancient and in secondary rocks, the latter of which, though very thick, do not extend to a very great distance. When in veins, this species is frequently attended with some of the ores of manganese. Acicular crystals of Limonite are met with in geodes of Quartz. Those varieties of clay iron-stone which belong to the present species, either form beds by themselves in secondary rocks, or they are imbedded in strata of clay, in the shape of larger or smaller globular concretions, some of them belonging to the coal formation, others to various kinds of sandstone.

5. Limonite is very plentiful in some countries. It occurs in beds in gneiss, along with granular limestone, at Friesach, at Hüttenberg, and in the valley of Lavant in Carinthia, at Turrach and Eisenerz in Stiria. Other localities, under similar circumstances, in Europe, are, Torotsko in Transylvania; Dobschau, Szirk, &c., in Hungary; Schneeberg in Saxony; Kamsdord and Saalfield, in Thuringia: though at some of these places it is said to occur in newer rocks. It is found in veins in various parts of Saxony, Nassau, the Hartz, &c. Göthite is found in the districts of Siegen and Sayns; the velvety varieties at Przibram in Bohemia; several crystallized varieties in the vicinity of Bristol, England, and in the lake of Onega in Russia. Rich varieties of the clay iron-ore occur in Bohemia, in Silesia, at Wehrau in Lusatia, and in Westphalia. The kidney shaped variety is met with near Teplitz in Bohemia, Tarnowitz in Silesia, in Poland, in several districts of Lower Stiria, &c. The pisiform clay iron-ore is found in Swabia, Franconia, Hessia, and in the district of Ayrshire in Scotland.

Limonite is one of the most widely diffused mineralogical species of the United States. Powerful beds of the fibrous brown hæmatite, accompanied by the ochery iron-ore, exist at Salsbury and Kent, in Connecticut, contained in mica-slate. In the neighboring towns of Beekman and Amenia, (N.Y.) similar deposits are met with. Farther north, under the same circumstances, at Richmond and Lenox, (Mass.) the like varieties of the present species occur. The mica-slate, which embraces the foregoing varieties, contains also beds of dolomite. At Hinsdale, the fibrous variety occurs as a cement to a fragmentary quartz rock. The nodular variety occurs at Gill, in the slate of the coal formation; it

is also abundant on Nantucket and Martha's Vineyard. Limonite is abundant at Bennington, Monkton, Pittsford, Putney and Ripton, in Vermont; at all of which places, it is more or less associated with ores of manganese. The argillaceous varieties are common in Pennsylvania, near Easton, and throughout the Lehigh range, in Fayette county at Armstrong, Upper Dublin, and in Washington county. Nodular argillaceous iron, in hollow balls from one inch to one foot in diameter, occur at Bladensburg, (Maryland.) Argillaceous iron-ore exists on mount Alto, in the Blue Ridge, at Hugh's mine, in Shenandoah co. (Va.); and in Chatham and Nash counties in North Carolina. Nodular fragments, which are perfectly compact and hard, occur disseminated through gravel-hills, near Marietta, in Ohio.

6. Limonite yields a considerable portion of the iron annually produced in the different parts of the globe. The pig-iron, obtained from melting its purer varieties with charcoal, in particular, may be easily converted into steel. The hard and compact nodular variety is much esteemed as a burnisher, in the polishing of metallic buttons.

Lincolnite.

Primary form. Right oblique angled prism. M on M = 120° c. g.

Secondary form. The primary, with the acute lateral edges truncated.

Cleavage, perfect parallel with P.

Lustre pearly on P. Color white. Transparent to translucent.

1. On hot coals, it whitens; and before the blow-pipe, melts into a spongy, white enamel.

2. It is found in the amygdaloidal cavities of trap at Deerfield, (Mass.) and upon gneiss, at Bellow's Falls, (Vt.)

3. As the largest crystals of this substance do not exceed one tenth of an inch in diameter, and as the angles given were obtained with the common goniometer, it will be necessary that their correctness be confirmed by the reflective goniometer, before the evidence that they are distinct from Heulandite, can be considered as completely satisfactory.

LIROCONITE. Lirokone Malachite-Haloide.

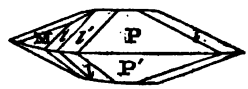
Primary form. Octahedron, with a rectangular base. P on P = 60° 40′. M on M′ = 72° 22′.

Liroconite.

Secondary form.

P on l'	179°	22′	PHILLIPS.
M on P	133	30	
l on l	178	10	

Fig. 281.



Cleavage, parallel with the primary planes, but effected with much difficulty. Fracture imperfectly conchoidal, uneven.

Lustre vitreous, inclining to resinous. Color sky-blue ... verdigris-green. Streak corresponding to the color, very pale. Semi-transparent ... translucent.

Nearly sectile. Hardness = 2·0 ... 2·5. Sp. gr. = 2·926.

Compound Varieties. Massive; composition granular, sometimes very distinct, but altogether rare.

1. Before the blow-pipe, it loses color and transparency, emits fumes of arsenic, and is changed into a friable scoria, containing some white, metallic globules. With borax, it yields a green globule, and is partly reduced. In nitric acid, it is soluble without effervescence.

2. *Analysis.*

By CHENEVIX.

Oxide of copper	49·00
Arsenic acid	14·00
Water	35·00

3. Lenticular Copper-Ore occurs in copper veins, along with various other ores of copper; also with Limonite, Quartz and Iron Pyrites.

4. It has been found only in some of the copper mines, near Redruth in Cornwall, and in minute crystals at Herrengrund in Hungary.

LITHOMARGE.

A pure, white, adhesive clay, from the decomposition of one or more species. That from Rochlitz in Saxony, consists, according to KLAPROTH, of

Silica	45·25
Alumina	36·50
Water	14·00
Oxide of iron	2·75

LYDIAN STONE. (See *Quartz.*)

MACLE. (See *Andalusite.*)

MACLURITE. (See *Brucite.*)

MAGNESITE. Staphyline Lime-Haloide.

Reniform, tuberose, massive. Composition columnar, individuals very delicate and diverging, producing a silky lustre; also impalpable. Fracture flat conchoidal, sometimes fine earthy.

Dull. Color yellowish grey, cream-yellow, yellowish and greyish white. Streak white and greyish white. Feebly translucent on the edges . . . opake.

Sp. gr. = 2·808. (No allowance being made for its imbibition of water.)

Adheres pretty strongly to the tongue.

1. Several varieties of the present species are distinguished by particular denominations. 1. *Meerschaum* or *Sea-foam*, which is contaminated with variable proportions of silica: it is opake, and possessed of an earthy fracture, yields easily to the nail, and adheres strongly to the tongue; occasionally it is very porous, so as to swim on water. Sp. gr. = 1·2 . . . 1·6. According to BERTHIER, a specimen from near Madrid, consisted of magnesia 23·8, silica 53·8, water 20·0, alumina 1·2.—2. *Compact Carbonate of Magnesia.* Color snow-white. Sp. gr. = 2·56. Gives sparks with steel, but does not scratch Fluor. It dissolves in acids, at ordinary temperatures, with extreme slowness, even when finely powdered; but by heat, its solution is quickened, attended with the extrication of carbonic acid gas. According to Dr. HENRY, it consists of magnesia 46, carbonic acid 51.—3. *Pulverulent Carbonate of Magnesia.* It is in the form of a light, white, powder, or in slightly cohering masses, resembling chalk. It appears to have resulted from the decomposition of Native Magnesia. It consists, according to WACHTMEISTER, who analysed a specimen from Hoboken, of magnesia 42·41, carbonic acid 36·82, water 18·53, silica and oxide of iron 2·23.

2. Before the blow-pipe, it is infusible. It dissolves with a slow effervescence in the nitric and dilute sulphuric, acids.

Magnesite.

3. *Analysis.*

	By Lampadius, from Mahren.	By Klaproth, from Steyermark.	By Walmstedt, from the Hartz.	By Buchole, from Hrubschiz.	By Stromeyer, from Baumgarten.
Magnesia	47·0	48·0	40·84	46·59	47·63
Carb. acid	51·0	49·0	48·58	51·00	50·75
Water	1·6	3·0	10·51	1·00	1·40
Ox. mang.	0·0	0·0	1·99	0·25	0·21
Ox. iron	0·0	0·0	6·16	0·00	0·00
Alumina	0·0	0·0	0 00	1·00	0·00
Lime	0·0	0·0	0·00	0·16	0·00
Silica	0·0	0·0	0·30	0·00	0·00

4. It occurs at Gulsen in Upper Stiria, in serpentine; at Hrubschiz, in Moravia, with the variety Meerschaum; at Baldifrero and Castellamonte, in Italy; at Valeccas in Spain, and at Baumgarten in Silesia. The compact variety, analyzed by Dr. Henry, was from the East Indies. The Meerschaum occurs in the Isles of Samos and Negropont, in the Archipelago; at Kiltschik in Natolia, where it is soft when first taken from the locality, but hardens on exposure to the air. The pulverulent variety is found in India. In the U. S. it occurs at Hoboken, (N.J.) disseminated through mamillary Dolomite, filling up narrow seams and cavities among the concretions, in opake, closely aggregated, white fibres. At the same place, also, in the pulverulent state, occupying seams sometimes half an inch wide, and also in crusts coating capillary crystals of Arragonite, and masses of Native Magnesia. The mineral analyzed by Wachtmeister, from Hoboken, probably contained a large quantity of hygrometric moisture. At Bolton, (Mass.) it is found in seams, traversing white limestone, in delicate, scarcely perceptibly fibrous, masses.

5. Magnesite is employed in porcelain manufactories. The meerschaum is made into pipes, and in Turkey is used for the same purposes as Fuller's earth.

6. The crystals of Magnesite, quoted by some writers, appear to belong to the species Rhomb Spar. So far as its properties are known, its place in the natural arrangement would be either within the genus Lime Haloide, where it is here placed, or it would form a new genus, next, preceding or following this genus.

MAGNETIC IRON. Octahedral Iron-Ore. MOHS.

Primary form. Regular octahedron.

Secondary forms.

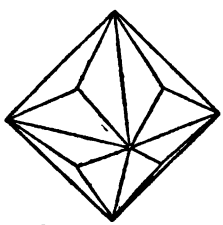
1.
Octahedron, with truncated edges.
Sweden. Haddam, (Conn.)
Franconia, (N. H.) Nova Scotia.

2.
Dodecahedron.
Traversella, Piedmont.
Franconia, (N. H.)

3.
Octahedron, with truncated angles.
Gulsen, Stiria.

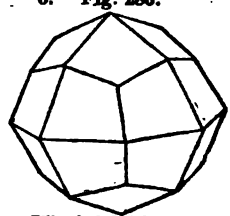
4.
Cube.
Gulsen, Stiria.

5. Fig. 282.



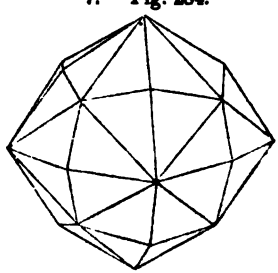
Zillerthal, Salzburg.

6. Fig. 283.



Zillerthal, Salzburg.

7. Fig. 284.



Zillerthal, Salzburg.

Irregular forms and grains.

Magnetic Iron.

Cleavage, parallel with the primary form: in some varieties perfect, and easily obtained; in others, entirely obliterated by conchoidal fracture. Fracture conchoidal, uneven. Surface, the dodecahedrons commonly streaked parallel to their edges of combination with the octahedron, faces of the octahedral trigonal-icositetrahedron (fig. 282.) smooth, though curved; the surface of all the other forms is smooth.

Lustre metallic; in some varieties, imperfectly. Color iron-black. Streak black. Opake.

Brittle. Hardness $=5{\cdot}5 \ldots 6{\cdot}5$. Sp. gr. $=5{\cdot}094$, octahedrons imbedded in chlorite.

Compound Varieties. Twin-crystals: axis of revolution perpendicular, face of composition parallel to a face of the octahedron. Massive: composition granular, of various sizes of individuals, and different degrees of cohesion. If the composition be almost impalpable, fracture becomes flat conchoidal, even or uneven.

1. Before the blow-pipe, it is infusible; but assumes a brown color, and loses its attractive influence over the magnetic needle, after having been exposed to a great heat. It is soluble in heated muriatic acid, but not in nitric acid. It may be obtained crystallized by fusing it; and crystals are likewise often produced in the process of roasting the ore which contains this mineral.

2. *Analysis.*

By Hisinger.

Protoxide of iron	94·33
Magnesia	0·16

The loss is oxygen, as the mineral contains both protoxide and peroxide of iron, according to Berzelius, in the proportion of 30·98 to 69·02, (the whole content of oxygen being 28·215,) or, according to Kobell, protoxide 24·48 to 25·92, and peroxide 74·08 to 75·52.

3. Magnetic Iron occurs in beds in primitive rocks, more commonly in gneiss, occasionally in clay-slate, hornblende-slate, chlorite slate,

greenstone, and sometimes in limestone. It is attended by Hornblende, Epidote, Pyroxene and Garnet.

4. Immense masses of this ore exist at Arendal in Norway, the Taberg in Smaland, in Sweden, and Chili. It occurs also in Saxony, Bohemia and the Hartz. It is met with in Corsica, in Unst, (one of the Shetland Isles,) in Russia and Siberia. It is also extremely abundant in the U. States. The most interesting crystallized varieties are found at Munroe, (N.Y.) lining the sides of veins in the massive ore; at Marlborough, (Vt.) imbedded in chlorite; and at Bridgewater, (Vt.) in chlorite slate; also at Franconia, (N.H.) imbedded in Epidote and Quartz. Immense beds of this ore exist in the gneiss, at different places upon the western side of Lake Champlain; also in the Highlands of New York, and in the mountainous districts of New Jersey and Pennsylvania.

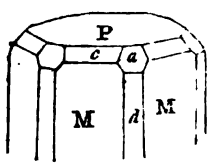
5. It is one of the most important ores of iron, in furnishing the metallic iron of commerce.

MAGNETIC IRON-PYRITES. Rhombohedral Bronze-Pyrites.

Primary form. Regular hexagonal prism.

Secondary form,

Fig. 285.



M on M′	-	-	120°	00′	Bournon.
M on *d*	-	-	150	00	
P on *a*	-	-	135	00	
P on *c*	-	-	102	13	

Cleavage, parallel with P perfect; less so with planes M. Fracture small, and imperfectly conchoidal. Surface rough, particularly M; sometimes also horizontally streaked. Subject to tarnish.

Magnetic Iron-Pyrites.

Lustre metallic. Color intermediate between bronze-yellow and copper-red. Streak dark greyish-black.

Slight action on the magnet. Brittle. Hardness =3·5 ...4.5. Sp. gr. =4·631, of a cleavable variety.

1. Heated in an open tube, it yields sulphureous acid; upon charcoal, in the exterior flame of the blow-pipe, it is converted into a red oxide of iron. In the interior flame, it melts with a good heat, into a globule, which continues to glow, a few moments after it is withdrawn from the fire. After cooling, it becomes an uneven, black mass. When broken, the fracture is crystalline, and the lustre metallic, with a yellowish color.

2. *Analysis.*

	By Hatchett.	By Rose.	By Stromeyer.	
Iron	63·50	38·78	59·85	56·37
Sulphur	36·50	60·32	40·15	43·63

The first of these analyses represents a bi-sulphuret of iron; the others are mixtures of the two sulphurets. It is often formed artificially in slags.

3. It occurs in beds along with other minerals containing iron, with Blende, Copper-Pyrites, and sometimes with Iolite. It forms an accidental ingredient of several rocks, and crystallizes in their fissures. Its presence has also been ascertained in several meteoric stones.

4. Small crystals occur at Andreasberg in the Hartz. The compound varieties occur more plentifully. There are cleavable ones at Bodenmais in Bavaria. Other varieties abound in Saxony, Silesia, the Hartz, and Stiria; also at Cornwall in England. The cleavable variety is found at Munroe, (Conn.) imbedded in Quartz, and attended by numerous ores; also in the next town, Trumbull, in a vein of Topaz and Fluor. The uncleavable variety occurs in Vermont, at Stafford and Shrewsbury; and at several places in Massachusetts; in which localities, it is attended by Iron Pyrites.

5. It is employed, along with Iron Pyrites, in the manufacture of copperas and sulphuric acid.

Malachite. (See *Blue Malachite* and *Green Malachite.*)

Malacolite. (See *Pyroxene.*)

MANGANBLENDE. Hexahedral Sclerone-Blende.

Primary form. Cube.

Secondary form. Regular octahedron.

Cleavage, parallel with the primary form, perfect; traces of cleavage, parallel with its edges. Fracture uneven, imperfectly conchoidal. Surface rough.

Lustre imperfectly metallic. Color iron-black. Streak dark-green. Opake.

Rather sectile. Hardness = 3·5 ... 4·0. Sp. gr. = 4·014.

Compound Varieties. Massive: composition granular, of various sizes of individuals; faces of composition irregularly streaked, or rough.

1. Before the blow-pipe, it is melted with difficulty, and only on its thinnest edges. It emits sulphuretted hydrogen, if reduced to powder, and when thrown into nitric, muriatic, or dilute sulphuric, acid, it is dissolved.

2. *Analysis.*

	By Klaproth.	By Vauquelin.
Protoxide of manganese	82·00	85·00
Sulphur	11·00	15·00
Carbonic acid	5·00	0·00

It is generally, however, considered as a sulphuret of manganese.

3. It is a rare mineral. It occurs chiefly in veins along with Black Tellurium, at Nagyag in Transylvania, and in Cornwall.

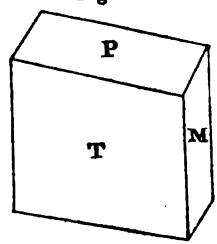
4. Del Rio mentions a variety of Manganblende, found at Oaxaca in Mexico, in which the cleavages are rhombohedral, and whose sp. gr. = 3·8. According to his analysis, it contains 41·7 sulphur, and 58·3 manganese.

MANGANESE SPAR. Tetarto-prismatic Parachrose-Baryte.

Primary form. Doubly oblique prism.

Manganese Spar.

Fig. 284.



M on T	- - -	121° 00′
M on P	- -	93 to 94 00
T on P	- - -	112 30

Secondary form. Similar to the form, fig. 189 of Feldspar; but having the faces at the extremities of the prism curved, and somewhat indistinct.

Cleavage, parallel with P, highly perfect; with M and T less easily obtained. Fracture conchoidal... uneven. Most of the faces are smooth, though they possess a lustre much inferior to that of the cleavage planes.

Lustre vitreous. Color pale flesh-red. Streak white. Transparent to translucent. Grows brown and opake from exposure to the weather.

Brittle. Hardness = 5·5...6·0. Sp. gr. = 3·4... 3·634.

Compound Varieties. Massive: composition granular, individuals sometimes large and lamellar, also fine granular, rarely columnar, strongly coherent. Sp. gr. = 3·612, from Longbanshytta; 3·634, from Siberia.

1. The supposed new species, *Fowlerite*, must be included within the Manganese Spar, as the most important properties of these minerals plainly show, although the Manganese Spar had never been observed in distinct crystals, previous to the discovery of the variety, Fowlerite. The substances called *Allagité*, *Corneous Manganese*, *Photizite*, and *Rhodonite*, are fine granular, or impalpable varieties, of the present species, occasionally mixed with a variable quantity of Spathic Iron. Their col-

Manganese Spar.

ors, are in general, several tints of green, brown and red, which become darker on exposure to the air.

2. Heated before the blow-pipe, it becomes dark-brown, and melts into a reddish brown or blackish glass, which in the variety from N. Jersey, is magnetic. With borax, it dissolves into a violet colored glass. Reduced to powder, and treated with muriatic acid, it is partly dissolved; the insoluble remainder assuming a white color.

3. *Analysis.*

Analysts.	Varieties analyzed, and localities.	Silica.	Oxide of manganese.	Oxide of iron.	Lime.	Magnesia.	Alumina.	Carbonic acid.	Water.
THOMSON.	*Fowlerite*, Franklin, (N.J.)	29·48	deutox. 17·716 protox. 34·64	perox. 13·22	0·00	0·00	0·000	0·00	3·17
"	*Silicate of manganese*, Stirling, (N.J.)	29·64	protox. 66·60	perox. 0·92	0·00	0·00	0·000	0·00	2·70
BERZELIUS.	from Longbanshytta.	48·00	protox. 49·04	traces.	3·12	0·22	0·000	0·00	0·00
BRANDES.	*Corneous mang'se*	34·00	54·857	0·50	traces.	0·00	0·000	8·00	2·00
"	" "	31·00	54·929	0·50	1·00	0·00	0·000	10·00	1·5
"	Common variety.	35·00	57·162	0·250	0·00	0·00	0·000	5·00	2·50
"	*Rhodonite.*	39·00	49·37	0·25	0·00	0·00	0·125	4·00	6·00
RUPRECHT.	from Kapnik.	55·06	35·15	7·04	0·00	0·00	1·56	0·00	0·78
DUMENIL.	Compact variety.	54.37	41·25	0·00	1·25	0·00	0·000	0·00	0·00
BRANDES.	" "	53·50	41·332	1·00	0·00	0·00	1·242	0·00	3·00
"	*Photizite*, color isabella-yellow.	39·00	46·13	0·50	0·00	0·00	0·000	11·00	3·00
"	grey.	36·00	37·393	0·50	0·00	0·00	6·000	14·00	6·00
DUMENIL.	" "	71·00	26·34	1·50	0·00	0·00	0·000	0·00	0·00
"	*Allagite*, green.	16.00	73·31	0·00	0·00	0·00	0·000	7·50	0·00
"	" brown.	16·00	75·00	0·00	traces.	0·00	0·000	7·50	0·00
LAMPADIUS.	from Siberia.	30·00	61·00	5·00	0·00	0·00	2·000	0·00	0·00
THOMSON.	from Cummington.	40·58	38·92	13·50	0·00	0·00	0·000	0·00	0·00

Manganese Spar—Manganite.

4. The variety Fowlerite occurs at Hamburgh, (N. J.) at the Franklin furnace, where it exists in the form of a bed in limestone, along with Magnetic Iron, Franklinite and Garnet. It also occurs at Sterling, (the variety which has been called Silicate of Manganese,) in a bed of Franklinite with Troostite, Automalite and Red Zinc-Ore; and again at Cumberland, (R.I.) where it is associated with Yenite.

The old variety, called Red Manganese, and Manganese Spar, is found at Longbanshytta in Sweden, in beds of iron-ore; near Elbingerode in the Hartz; in the district of Catherinenberg in Siberia; also near Callington in Cornwall. In the United States, it has been found abundantly at Cummington, (Mass.) where it exists in large, rolled masses, disseminated through the soil. The varieties called Allagite, Corneous Manganese, Photizite and Rhodonite, occur near Rübeland in the Hartz.

5. It is cut and polished by the lapidary, and employed for inlaid work.

6. It is difficult to decide whether Manganese Spar is with greater propriety placed within the genus Parachrose-Baryte, than in that of Augite-Spar. Its specific gravity, color, and liability to grow darker, from exposure to the weather, however, rather favor the disposition here made.

Manganesian Epidote. (See *Epidote.*)

MANGANITE. Prismatoidal Manganese-Ore. Mohs.

Primary form. Right rhombic prism. M on M = 99° 40′.

Secondary forms.

Fig. 287.

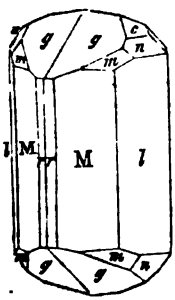
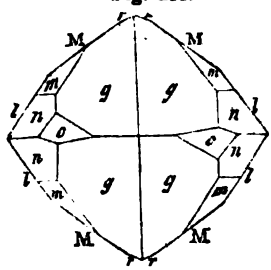
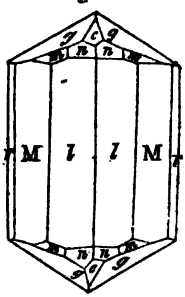


Fig. 288.



Manganite.

Fig. 289.



g on *g*	- -	172°	36′	HADINGER	*m* on *m*	- -	112°	35′
c on *c*	- -	115	17		*l* on *l*	- -	51	18
n on *n*	- -	95	4		*r* on *r*	- -	134	14

Cleavage, parallel with *l* highly perfect, and easily obtained; with M also perfect, but less easily obtained; traces of *r*. Fracture uneven, surface of the vertical planes streaked parallel to their common edges of intersection. In general, the faces are smooth, and possess pretty high degrees of lustre.

Lustre imperfectly metallic. Color dark, brownish black, inclining to iron-black. Streak, reddish brown. Opake in larger masses; when broken, or cleaved in the direction of *l*, and exposed to the light of the sun, minute splinters are often observed, which, by transmitted light, appear of a bright, brown color.

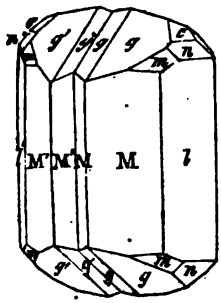
Brittle. Hardness =4·0 . . . 4·25.* Sp. gr. = 4·328.

* In the description given above, the streak of the crystals is stated to be reddish brown. It is very often the case, however, that crystals are met with, and still more frequently compound varieties, consisting of columnar individuals, which actually afford a black streak. The hardness of these varieties is much inferior to that of the crystals which

Manganite.

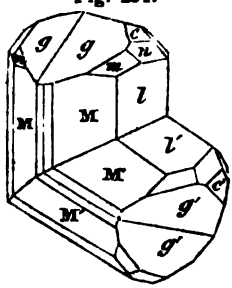
Compound Varieties. Twin-crystals. 1. Face of composition parallel to *l*, axis of revolution perpendicular to it.

Fig. 290.



A repetition of this law produces thick prisms, terminated perpendicularly upon their axis by a rough face, which consists of the apices of numerous individuals, or rather of numerous particles of two individuals, alternating with each other. 2. Axis of revolution perpendicular, face of composition parallel to a plane of the pyramid.

Fig. 291.



present a brown streak, being generally between 2·5 and 3·0; and sometimes in fibrous varieties, it is so inconsiderable as to soil the fingers and write upon paper. On the contrary, their specific gravity is higher, and

Massive: composition granular, or columnar,—the latter more frequently.

1. It is infusible before the blow-pipe, and colors glass of borax, violet-blue. It is insoluble in nitric acid. In heated sulphuric acid, it disengages chlorine. Also, before the blow-pipe, or alone, in a strong heat, it gives out oxygen.

2. *Analysis.*
By TURNER.

Protoxide of manganese - - - - - -	80·92
Oxygen - - - - - - - -	8·98
Water - - - - - - - -	10·10

3. Manganite occurs in abundance, and great beauty, at Ihlefeld in the Hartz, and at Oehrenstock near Ilmenau in Thuringia.

MARCELLINE. (See *Black Manganese.*)

MAREKANITE. (See *Pitchstone.*)

MARGARITE. Rhombohedral·Pearl-Mica. MOHS.

Primary form. Rhomboid, of unknown dimensions.

Secondary form. Hexagonal plates.

Cleavage, parallel with the bases of the hexagonal plates, highly perfect; also traces parallel with the sides of such plates. Fracture not observable. Surface of bases triangularly streaked, of sides horizontally streaked, though faintly.

Lustre, common pearly upon the bases of the hexagonal tables, both in faces of crystallization and of cleavage; vit-

often approaches to 4·7. It is important to observe, that the exterior strata of large crystals sometimes afford a black streak, and show low degrees of hardness, while the interior parts still offer the characters indicated in the preceding description. It would seem, therefore, that the difference in several of these properties, is owing to a change or decomposition of the substance itself, which does not affect the regular form.

reous upon the other faces. Color pale pearl-grey, passing into reddish-white and yellowish-white. Streak white. Tranuslucent.

Rather brittle. Hardness = 3·5 . . . 4·5. Sp. gr. = 3·032.

Compound Varieties. Massive: composition granular, individuals of various sizes, faces of composition seldom observable, rough, sometimes smooth.

1. *Analysis.*
By Du Menil.

Silica	37·00
Alumina	40·50
Oxide of iron	4·50
Lime	8·96
Soda	1·24
Water	1·00

2. Margasite has been found in a bed in primitive rocks, mixed with, and engaged in, the variety of Talc called foliated chlorite, at Sterzing in the Tyrol, where it is accompanied by foliated Fluor, and Crichtonite.

Marmatite.

A Blende from Marmato, which is black, and possessed of a lamellar structure; and contains, according to Boussingault,

Sulphuret of zinc	77·5	76·8
Proto-sulphuret of iron	22·5	23·2

Marmolite. (See *Kerolite.*)

Martite.

A variety of Octahedral Iron, which contains no protoxide of iron.

MASCAGNINE. Volatile Bitter-Salt.

Stalactitic. Massive: pulverulent.

Color yellowish-grey, white. Semi-transparent.

Taste bitter.

1. It is, apparently, a pure sulphate of ammonia; and is found in efflorescences, upon recent lava, at Etna and Vesuvius; upon decomposed lavas of Puzzuolo, in the coal measures of Aubin and Aveyron, on the surface of sandy plains near Turin, and dissolved in the lakes of Tuscany.

MEERSCHAUM. (See *Magnesite.*)

MEIONITE. (See *Scapolite.*)

MELACONITE. Cupreous Lusine-Ore.

Massive; composition impalpable; earthy and pulverulent.

1. Fusible before the blow-pipe into a black scoria, and yielding globules of copper in the reduction flame. It is soluble in nitric acid, without the disengagement of gas. According to BEUDANT, it consists of

Oxygen - - - - -	20·17
Copper - - - - -	79·83

It often contains the hydrated oxides of iron and manganese.

2. It occurs in all copper mines, and is probably derived from the decomposition of Copper Pyrites and Blue Malachite. That which is derived from the decomposition of the latter species, is nearly pure.

3. The most remarkable localities are Chessy near Lyons, Rheinbreitbach on the Rhine, Lauterbach and Zellerfeld in the Hartz, Kupferberg in Silesia, Hungary, Bannat and Cornwall.

MELANITE. (See *Garnet.*)

MELANOCHROITE.

In rhombic prisms, having two faces enlarged, so as to impart to the crystals a tabular shape.

Lustre resinous, dull. Translucent on the edges, to opake. Color hyacinth-red, to orange-red. Powder brick-red. Sp. gr. = 5·75.

Compound Varieties. Massive. Composition impalpable.

1. Before the blow-pipe, it melts easily into a brown mass, which, on cooling, assumes a crystalline structure.

2. *Analysis.*

By HERMANN.

Oxide of lead - - - -	76·36
Chromic acid - - - -	23·64

Mellite.

3. It is found at Beresofsk in the Ural, accompanied by Red Lead-Ore, Pyromorphite, Vauquelinite and Galena.

MELILITE.

Primary form. Right square prism.

Secondary form. The primary, with its lateral edges truncated. Fracture imperfectly conchoidal.

Color yellow, inclining to red or green. Opake.

Hardness = 5·5 . . . 6·0. Sp. gr. = 3·041.

1. Before the blow-pipe, it melts, without ebullition, into a greenish glass. Reduced to powder, it gelatinizes with nitric acid.

2. *Analysis.*

By CARPI.

Silica	38·00
Lime	19·60
Magnesia	19·40
Alumina	0·90
Oxide of iron	12·10
Oxide of titanium	4·00
Oxide of manganese	2·00

3. It is found at Capo di Bove, and Tivoli near Rome, accompanied by Nephiline, in the fissures of a volcanic rock.

4. It will probably prove, if its hardness and specific gravity can be relied upon, to be a new species.

MELLITE. Pyramidal Melichrone-Resin. MOHS.

Primary form. Octahedron with a square base. P on P = 93°.

Secondary forms.

1. Primary, with the summits truncated.

2. The same, with the truncation of the angles of the base.

3. The same as 2, with the truncation of the upper edges of the octahedron.

Mellite.

Cleavage, parallel with P very difficult. Fracture conchoidal. Surface of the truncated summits rough and curved; of the planes on the pyramidal edges rough; the rest of the planes smooth and shining.

Lustre resinous, inclining to vitreous. Color honey-yellow, inclining often to red and brown. Streak white. Transparent... translucent.

Sectile. Hardness $=2{\cdot}0 \ldots 2{\cdot}5$. Sp. gr. $=1{\cdot}597$.

Compound Varieties. Small massive nodules: composition granular.

1. It loses color and transparency, when exposed to the flame of a candle, and is soluble in nitric acid.

2. *Analysis.*

	By Klaproth.	By Wohler.
Alumina	16·00	41·4
Mellitic acid	46·00	14·5
Water	38·00	44·1

3. It is found only at Artern in Thuringia, where it exists in a bed of brown coal, sometimes attended by Sulphur.

Menaccanite. (See *Iserine.*)

Mengite.

Primary form. Right rhombic prism. M on M $=136° 20'$.

Secondary form. Primary, with the terminal edges replaced by single planes, inclining to the lateral planes under angles of $140° 30'$.

Cleavage, parallel with the secondary planes in traces. Fracture conchoidal, to uneven.

Color black.

Hardness. Scratches glass. Sp. gr. $=5{\cdot}43$.

It is found in Siberia.

Menilite. (See *Opal.*)

Mesole. (See *Mesotype.*)

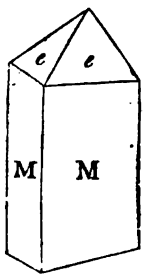
Mesolite. (See *Mesotype.*)

MESOTYPE. Prismatic Kouphone-Spar. MOHS.

Primary form. Right rhombic prism. M on M = 91° 20′.

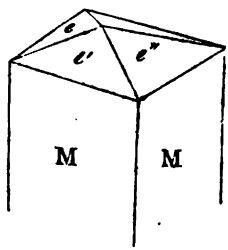
Secondary forms.

Fig. 292.



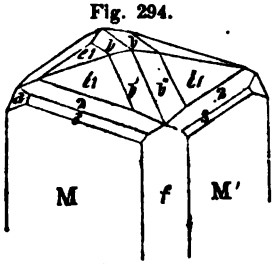
Cheshire, (Conn,)

Fig. 293.



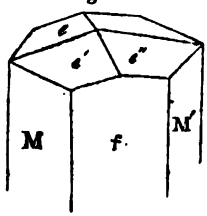
Cheshire, (Conn.)

Fig. 294.



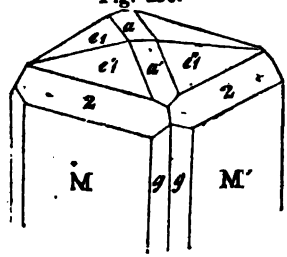
Iceland.

Fig. 295.



Mesotype.

Fig. 296.



Faroe.

Fig. 292. Primary form, surmounted by dihedral summits. e on $e=143^\circ\ 35$.—Fig. 293. Primary, terminated by four-sided pyramids. e' on $e''=143^\circ\ 35'$. e' on $e=142^\circ\ 33'$. PHILLIPS.—Fig. 294. b on $b''=146^\circ\ 23'$. PHILLIPS. $e'2$ on $e''2=142^\circ\ 38'$. PHILLIPS.—Fig. 295. M on $f=135^\circ\ 35'$. e' or e'' on $f=109^\circ\ 18'$. PHIL. var. Natrolite.—Fig. 296. $e''1$ on $a=162^\circ\ 15'$. M on $g=162^\circ\ 30'$. PHILLIPS.

Cleavage, parallel with M perfect. Fracture conchoidal, uneven. Surface of the replaced lateral edges, striated vertically; the rest of the faces smooth.

Lustre vitreous. Color few shades of white, generally greyish or yellowish. Streak white. Transparent... translucent.

Brittle. Hardness = 5·0 ... 5·5. Sp. gr. = 2·249.

Compound Varieties. Implanted globular shapes: surface drusy, composition columnar. Massive: composition columnar, consisting of delicate, straight, and generally divergent individuals, radiating from a centre; sometimes aggregated into angulo-granular masses. Spheroidal shapes, formed in vesicular cavities.

Mesotype.

1. Before the blow-pipe, it loses its transparency, and melts into a glassy globule: the radiated varieties exfoliate, and the compact ones intumesce. They are with difficulty soluble in borax. Some of them assume by heat, faint degrees of opposite kinds of electricity on their opposite ends, and become positively electric by friction.

2. *Analysis.*

	By Gehlen & Fuchs.				By Berzelius.	By Smithson.
	var. Scolezite, from Staffa.	var. Mesolite, from Iceland.	from Hohentweil.	var. Natrolite, from Tyrol.	var. Mesole.	var. Mesolite, from Faroe.
Silica	46·75	47·46	47·21	48·63	42·60	49·0
Alumina	24·82	25·35	25·60	24·82	38·00	27·0
Soda	0·39	4·87	16·12	15·69	5·63	17·0
Lime	14·20	10·04	0·00	0·00	11·43	0·0
Water	13·64	12·41	8·88	9·60	12·70	9·6
Ox. of iron	0·00	0·00	1·35	0·21	0·00	0·0

3. The general repositories of this species are the vesicular cavities of amygdaloidal rocks. It occurs associated with Analcime, Chabasie, and Calcareous Spar.

4. The most distinguished localities are Iceland, Scotland, the Faroe Islands, the Isle of Bourbon, Auvergne and Tyrol. It also occurs abundantly in the basalt of the Giant's Causeway. The variety Natrolite, and which is of a yellowish grey color, is found in a porphyritic rock near Lake Constance; also at Klingstone near Hohentweil in Swabia. Mesotype, with the exception of one localitiy in Nova Scotia, is a rare mineral in North America. It is met with, however, in small quantities, in the trap of New England, and rarely in seams between Hornblende and Gneiss. The most interesting specimens in the first mentioned rock, occur at Cheshire, (Conn.); and in the latter, at Washington, in the same state.

Metaxite.

Massive: composition columnar, in extremely thin individuals; impalpable.

Lustre silky. Color greyish white. Translucent on the edges. Shining in the streak.

Hardness (scale of Breithaupt) = 3·0 . . . 4·0. Sp. gr. = 2·520.

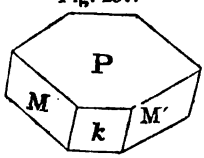
1. It is fusible before the blow-pipe, yielding moisture; with soda, it melts into a white globule; with salt of phosphorus, flocculi of silica appear. It appears, therefore, to be some earthy silicate.

MICA. Rhombohedral Talc-Mica. MOHS.

Primary form. Oblique rhombic prism. M on M′= 120°. M on P=98° 40′.

Secondary forms.

Fig. 297.



Acworth, (N.H.) Greenfield, (N.Y.)

Fig. 298.

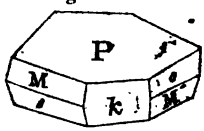


Fig. 297. P on k=90°. M on k=120°. P on M= 98° 40′. P on M′=81° 20′.—Fig. 298. P on o = 90°.

Cleavage, parallel with P highly perfect, and easily obtained; also traces of cleavage parallel with M M′. Fracture scarcely observable, uneven. Surface, k and M, horizontally streaked; the other faces, particularly P, smooth. Lustre pearly, often inclining to metallic upon P: the other faces, if they are smooth enough, present a kind of lustre between vitreous and adamantine. Color various shades of grey, generally passing into green, brown, and black; also with white and red, (particularly, peach-blossom red.) Superficial tinges of pinch-beck brown. Streak white, grey. Transparent, imperfectly . . . translucent on the edges. It is less transparent in the direction of the axis, than perpendicular to it; and generally exhibits

different colors when viewed in these directions; for instance, oil-green in the first, and liver-brown in the second.

Sectile. Thin laminæ are elastic. Hardness =2·0... 2·5. The acute edges of the laminæ, however, will sometimes scratch Fluor. Sp. gr.=2·949, a greenish black variety, in large individuals. =2·832 of Lepidolite.

Compound Varieties. Twin-crystals; axis of revolution perpendicular, face of composition parallel to one of the faces of M. The composition is often repeated parallel to both the faces of M. The individuals rarely project beyond the face of composition. When they do not, the composition is only obvious from the intersecting striæ upon P, and from the cleavages produced. In this way the star-like crystals, of a large size, found at Acworth, (N. H.) are produced. The same composition is frequent in massive varieties, in large individuals, particularly in the large cleavage forms found at Munroe, (N.Y.) and at Mendham, in New Jersey, whose numerous cleavages are easily explained upon this supposition. Globular forms, both imbedded and implanted: surface of the latter rough; composition columnar, sometimes joining in a second curved lamellar composition. Massive: composition granular, of various sizes of individuals; or also imperfectly columnar, faces of composition irregularly streaked and rough.

1. In the present species must be included the old species Pinite, originally described from France. It appears to be only an impure, crystallized Mica, contaminated by chloritic Talc, or in some cases pure Mica, which is partially decomposed. The annexed figures represent the bases of very distinct crystals, (some of which are at least an inch in diameter,) from Lancaster, (Mass.) and from Haddam, (Conn.)

Mica.

Fig. 299.

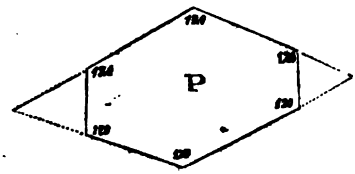


Fig. 300.

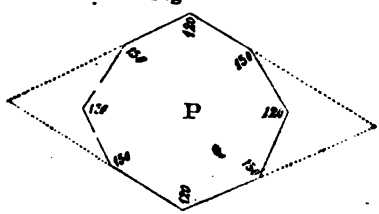
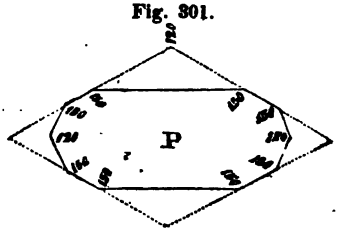


Fig. 301.



The inclination of P to the lateral planes is generally 90°; in a few cases, it is 96°, or a little above. When 90°, the planes M do not appear upon these crystals. Color dark greenish or bluish grey. Cleavage parallel with P. Fracture uneven. Sp. gr. = 2·893, of a crystal from Lancaster. Emits an argillaceous odor when moistened.

2. Before the blow-pipe, several varieties first lose their transparency, and then melt into a scoria, or into a glass, white or colored, or even black. Others are infusible, and they show in general as much difference in this respect, as in their composition.

3. *Analysis.*

Analysts.	Varieties of Mica, and localities.		Silica.	Alumina.	Magnesia.	Lime.	Lithia.	Potash.	Oxide of iron.	Oxide of mang.	Oxide of titanium.	Fluoric acid.	Water.	Total.
PESCHIER.		Siberia.	40·25	22·00	0·00	1·75	0·00	7·25	8·75	2·00	13.00	3.24	0·00	98·24
KLAPROTH.	In large foliæ.	Siberia.	48·00	34·25	0·50	0·00	0·00	8·75	4·50	trace.	0·00	0·00	0·00	96·00
	Silver white.	Zinnwald.	47·00	20 00	0·00	0·00	0·00	14·50	15·50	1·75	0·00	0·00	0·00	98·75
	Black.	Siberia.	42·50	11·50	9·00	0·00	0 00	10·00	22·00	2·00	0 00	0·00	0·00	97·00
ROSE.		Fahlun.	46·22	34·52	2·11	0·00	0·00	8·22	6·04	0·00	0·00	1·09	0·98	0·00
		Utoe.	47·50	37·20	trace.	0·00	0·00	9·60	3·20 protox.	0·06	0·00	0·56	2·63	101·59
		Broddbo.	46·10	31·60	trace.	0·00	0·00	8·39	8·65 protox.	0·00	0·00	1·12	1·00	98·26
		Kimito.	46·358	36·800	trace.	0·00	0·00	9·220	4·53	0·96	0·00	0·765	1·84	99·518
TURNER.	Silver-white.	Zinnwald.	40·28	24·53	trace.	0·00	4·09	9·47	11·33 protox.	1·66 protox.	0·00	5·14	0·00	100·50
	Greenish.	Altenberg.	40·19	22·72	trace.	0·00	3·06	7·49	19·78 perox.	2·02 protox.	0·00	3·99	0·00	99·75
	Grey.	Cornwall.	50·82	21·33	trace.	0·00	4·05	9·86	9·08 black.	trace	0·00	4·81	0·00	99·95
	Brown.	Cornwall.	40·06	22·90	trace.	0·00	2·00	4·30	27·06	1·79	0·00	2·71	0·00	100.87
GMELIN.	Yellowish-grey.	Zinnwald.	46·233	14·141	0·00	0·00	4·206	4·900	17·973	4·573	0·00	8·530	0·831	101·387
	Peachblossom-red.	Churadorf.	52·254	28·345	0·00	0·00	4·792	6·903	0·00	3·663	0·00	5·069	trace.	101·026
	Lepidolite.	Rozena.	49·060	33·611	0·480	0·00	3·592	4·186	trace.	1·402	0·00	3·445 & 0·112 phl'ic acid.	4·184	100·000
	Pinite.	Auvergne.	55·964	25·480	8·760	0·00	0·00	7·890 & 0·386 soda.	5·512	0·00	0·00	0·00	1·410	100·402
THOMSON.		Paris ? (Me.)	49·380	23·668	0·00	6·134	0·061	15·292	7·312	0·00	0·00	0·00	0·00	101·847
	Emerald green.	Brunswick, (Me.)	64·44	28·844	0·00	0·00	0·00	0·00	4 4·28 perox.	0·00	0·00	0·00	1·00	98·712
WENZ.	Lepidolite.		49·06	33 61	0·41	0·00	3·60	4·18	0·00	1·40	0·00	3·45	4·18	99·69
BEUDANT.	Silver white.	Zillerthal.	51·3	31·9	3·1	5·2	0·00	6·2	0·00	0·00	0·00	2·1	0·00	0·00

Mica.

4. Mica forms one of the constituents of various rocks, as granite, mica-slate, gneiss, porphyry, and some kinds of sandstone. They form, sometimes, more or less considerable concretions in these rocks, and contain imbedded crystals of Topaz, Tourmaline, and other species. As single crystals, they often appear imbedded in granular limestone, in basalt and wacke, and as implanted crystals, they are found upon the specimens ejected from Vesuvius. Several varieties of Mica accompany ores of tin and tungsten, in metalliferous beds.

5. Mica, in extraordinarily large individuals, is found in Siberia; at Zinnwald, in Saxony, it occurs in crystals, possessing two axes of double refraction. It is also found in the Hörlberg in Bavaria, in imbedded globules in Moravia, at Mount St. Gothard in Switzerland, at Finbo in Sweden, Pargas in Finland, at Wisenthal in Saxony, and Joachimsthal in Bohemia, imbedded in basalt and wacke. At Mount Vesuvius, crystals of Mica, with one axis, often of considerable size and transparency, occur in the drusy cavities of the ejected specimens. Lepidolite occurs near Rozena in Moravia, and at Utö in Sweden. Pinite is found, in granite, at Schneeberg in Saxony, in Auvergne and Cornwall.

The localities of Mica in the United States, are numerous and interesting. Distinct crystals, often remarkable for their size and perfection, occur at Acworth, (N. H.) in granite, implanted upon Feldspar: here also occur the twin crystals, and massive variety, in large individuals, aggregated also after the manner of the twin crystals. Very handsome crystals are found at Greenfield, near Saratoga, in the granite vein that contains Chrysoberyl, Tourmaline and Feldspar crystals: the Mica from this place is of a rich oil-green color when viewed across the axis, and reddish-brown perpendicular to it. Small but distinct crystals exist in the limestone of Orange county, (N. Y.) associated with Spinel and Brucite. Rose-colored crystals are found in the tourmaline granite of Goshen and Chesterfield, (Mass.) and in general, nearly all the deposits of Beryl throughout New England contain, occasionally, crystals of Mica. Highly perfect cleavage-crystals, of great size and of dark greenish black color, are contained in a vein about one foot in width, near the iron mines of Munroe, at Greenwood, (N. Y.) A similar variety, but partly decomposed, is found in the soil at Mendham, (N. J.) Individuals nearly a foot across, occur at Paris in Maine: these are of a rich brown color, and often penetrated by Tourmaline crystals. A yellow, somewhat copper-colored variety, massive and in six-sided tables of large size, is found at Henderson, Jefferson county, (N. Y.) A dark brown colored Mica,

in plates of moderate size, has been met with near Moriah upon Lake Champlain: also black mica in the same region at Willsborough, and a pinchbeck-brown variety in Lower Canada. An emerald-green variety, in minute scales, disseminated through quartz, occurs at Brunswick, (Me.) Lepidolite, in beautiful varieties, exists at Paris, (Me.) where it is often penetrated, as at Rozena in Moravia, by Rubellite: in small quantities, also, at Middletown, (Conn.) under similar circumstances. Pinite is found at Lancaster, (Mass.) imbedded in Quartz, associated with Andalusite, and at Haddam, (Conn.) with Chrysoberyl, Garnet, Tourmaline, &c.

Appendix to Mica.

i. *Tautokline Aster-Mica.* Breithaupt.

Primary form. Acute rhomboid. P on P = 66° 11′ 20″.

Cleavage perfect parallel with planes, tangent to the angles of the base; with the primary faces, imperfect.

Lustre pearly. Color green, to greenish white. Having but a single optical axis. Streak greenish-white.

Flexible in thin laminæ. Hardness (scale of Breithaupt) = 2·25 . . . 2·50. Sp. gr. = 2·821 . . . 2·885.

1. The foliated chlorite from Zillerthal, and a portion of the old species Mica, belong to the present division.

ii. *Rubellan Aster-Mica.* Breithaupt.

Primary form. Acute rhomboid. P on P = 66° 19′ 50″.

Cleavage as above.

Lustre pearly. Color brownish red to reddish brown. Optical axis single. Streak the same as color.

Brittle. Hardness (scale of Breithaupt) = 2·50 . . . 3·0. Sp. gr. 2·697 . . . 2·717.

1. This mineral is found only in the Mittelgebirge in Bohemia.

iii. *Kuphone Aster-Mica.* Breithaupt.

Primary form. Acute rhomboid.

Cleavage as above.

Lustre pearly. Color green. Optical axis single. Streak greenish-grey, pale.

Flexible in thin laminæ. Hardness (scale of Breithaupt) = 2·25 . . . 2·50.

1. The Kuphone Aster-Mica occurs in serpentine, at Waldheim, Kuhschnappel and Kursdorf in Penig.

Mica.

iv. *Trappean Aster-Mica.* BREITHAUPT.

Primary form. Acute rhomboid.

Cleavage as above.

Lustre pearly. Color black to dark brown. Optical axis as above. Streak yellowish grey.

Flexible in thin laminæ. Hardness (scale of BREITHAUPT) = 2·50 . . . 3 0. Sp. gr. = 2.776.

v. *Axotomous Aster-Mica.* BREITHAUPT.

Primary form. Acute rhomboid. P on P = 67°, about.

Lustre pearly. Color greenish grey, to white. Optical axis single. Streak white.

In thin laminæ, flexible. Hardness (scale of BREITHAUPT) = 2 50. Sp. gr. = 2·780.

1. This is the variety from Munroe, (N. Y.)

vi. *Dichromatic Aster-Mica.* BREITHAUPT.

Primary form. Acute rhomboid. Inclination of P to the axis = 15° 14′ to 15° 15′.

Cleavage as above.

Lustre pearly. Color green. Green parallel with the vertical axis, hyacinth red at right angles to it.

Flexible in thin laminæ. Hardness (scale of BREITHAUPT) = 2·75.

1. From Zillerthal and from Binden in Switzerland.

vii. *Black Aster-Mica.* BREITHAUPT.

Color black. Olive-green, in very thin laminæ.

Sp. gr. = 2·507.

viii. *Lepidolite Rock-Mica.* BREITHAUPT.

Primary form. Oblique rhombic prism. M on M = 119°.

Cleavage parallel with M perfect, with the shorter diagonal only in traces.

Lustre pearly. Color pale red, to light grey. Optical axis double. Streak white.

Flexible in thin laminæ. Hardness (scale of BREITHAUPT) = 3·0. Sp. gr. = 2·827 . . . 2·855.

1. To this species, belongs the varieties of Mica, called Lepidolite, and some others.

IX. *Hemidomatic Rock-Mica.* BREITHAUPT.

Primary form. Oblique rhombic prism. M on M = 118°.

Cleavage, parallel with M, perfect; with the shorter diagonal, in traces.

Lustre metallic pearly. Color grey and brown. Optical axis double. Streak greyish white.

Flexible in thin laminæ. Hardness (scale of BREITHAUPT) = 2·0. Sp. gr. = 2·956 . . . 2·983.

1. The present species is cited from Zinnwald, Bohemia.

X. *Siderose Rock-Mica.* BREITHAUPT.

Primary form. Oblique rhombic prism.

Cleavage, perfect parallel with M.

Lustre pearly. Color dark green to black. Optical axis double. Streak green to greenish grey.

Slightly flexible in thin laminæ. Hardness (scale of BREITHAUPT) = 3·25 . . . 3·50. Sp. gr. = 3·146 . . . 3·190.

1. Locality, Altenberg, Saxony.

X. *Rhombohedral Chrysophane-Mica.* BREITHAUPT.

Primary form. Acute rhomboid.

Cleavage, the same as in Tautokline Aster-Mica.

Lustre metallic pearly. Color yellowish brown to pinch-beck brown. Optical axis single. Streak yellowish grey, almost pale.

Scarcely flexible in thin laminæ. Hardness (scale of BREITHAUPT) = 5·0 . . . 5·50. Sp. gr. = 3·071.

1. This mineral is said by BREITHAUPT, to have been sent to Europe from the United States, under the name of Clintonite, and to be found at Warwick, (N.Y.) Its locality is more probably Amity; and it appears to be the variety of Bronzite, described page 89, vol. i. of this work.

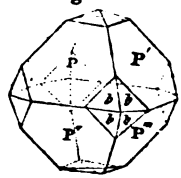
MICROLITE. Octahedral Tungstic-Baryte.

Primary form. Regular octahedron.

Secondary forms.

Fig. 302.

Fig. 303.



Cleavage, parallel with the primary faces, imperfect. Fracture conchoidal, passing to uneven. Surface of the primary faces, generally dull; those of *b* also.

Lustre resinous. Color straw-yellow, to dark reddish-brown. Transparent to translucent on the edges. Streak white, except when the color of the mineral is brown; it then resembles the color.

Brittle. Hardness=5·0...5·5. Sp. gr.=4·75...5·00.

1. Alone before the blow-pipe, it remains unaltered. It is slowly dissolved in the glass of borax, to which it communicates a yellow color, that grows paler on cooling, but remains transparent unless subjected to flaming, when it becomes nebulous, and presents on cooling, a pale yellow enamel. It is not readily acted upon by carbonate of soda. Insoluble in nitric acid. Its chief ingredient is probably the *oxide of cerium*.

2. It is found at Chesterfield, (Mass.) in the vein of Albite, which contains the green and red Tourmaline. The largest crystals yet seen, weigh but 0·4 of a grain. They are disseminated through the Albite, particularly near its junction with the smoky Quartz.

MIEMITE. (See *Dolomite*.)

MIKROKLIN. (See *Feldspar*.)

MIMETENE.

Primary form. Regular hexagonal prism.

Secondary form. Terminal edges replaced by single planes.

Cleavage, parallel with the primary faces, imperfect; scarcely visible parallel to the bases of the prism.

Mimetene.

Fracture imperfectly conchoidal, uneven.

Surface horizontally streaked and uneven; the prisms are often barrel-shaped, or contracted at the ends.

Lustre resinous. Color pale yellow, passing to brown. Semi-transparent . . . translucent.

Brittle. Hardness = 3·5 . . . 4·0 ? Sp. gr. = 5·0 . . . 6·4. (7·2 KOBELL.)

Compound Varieties. Globular, reniform, botryoidal, fruticose shapes: massive, composition columnar, or granular.

1. Alone, on charcoal, before the blow-pipe, it melts with some difficulty, and is reduced at once to a number of globules of lead, attended with the copious disengagement of smoke, and the odor of arsenic. When a small crystal is held by the forceps in the exterior flame of the blow-pipe, the part within the flame melts, and on being allowed to cool, crystallizes like the phosphate of lead under similar circumstances.

2. *Analysis.*

	By WOHLER, fr. Johangeorgenstadt.	By GREGOR, fr. Cornwall.		By BINDHEIM, fr. Nertschink, Siberia.
Oxide of lead	75·59	69·76		85·00
Phosphoric acid	1·32	0·00	Oxide of iron	14·00
Arsenic acid	21·20	26·40		25·00
Muriatic acid	1·89	1·58	Silica	7·00
			Alumina	2·00
			Silver	1·15
			Water	10·00

The specimen analyzed from Siberia was probably impure, from the presence of hydrate of iron.

3. This mineral occurs in veins in various rocks, accompanied by Galena, Copper Pyrites, Fluor, Quartz, &c. Capillary varieties are found at St. Prix in the department of the Saone in France. In England, it occurs crystallized in a copper vein in granite, in Huel Unity, Cornwall; also in the parish of Endellion, and in the lead mines of Devonshire. The locality of Johangeorgenstadt, affords handsome crystals of a yellow color; that of Nertschinsk in Siberia, furnishes reniform masses, of a brownish red color.

4. As yet, there does not appear to be sufficient ground for distinguishing the Mimetene from Pyromorphite.

MINERAL HYDRO-CARBON.

In acicular crystals.

Lustre nacreous. Color white, or yellowish white. Sp. gr. = 0·65.

1. It melts at 112° F., and distils at 194°, condensing unaltered. It dissolves slowly in alcohol, but more rapidly in ether and oil of turpentine.

2. *Analysis.*

Carbon - - - - - - -	73
Hydrogen - - - - - - -	24

3. It is found between layers of lignite, near Urnach, canton of St Gall, Switzerland.

MINIUM. Molybdic Lusine-Ore.

Massive: composition impalpable, pulverulent. Color aurora-red.

Sp. gr. = 4·6.

1. In the reducing flame of the blow-pipe, globules of metallic lead are produced. It passes to the state of the brown oxide, through the action of nitric acid. It probably consists of lead 89·62, and oxygen 10·38.

2. It is only met with in very small quantities in veins of Galena, and also, associated with Calamine.

3. Its localities are Bleialf in Elfeld, Badenweiler in Baden, Brillon in Westphalia, Island of Anglesea, Grassington-Moor, and Grass-hill chapel in Yorkshire.

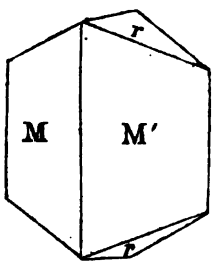
MISPICKEL. Prismatic Eruthleucone-Pyrites.

Primary form. Right rhombic prism. M on M = 111° 12′.

Mispickel.

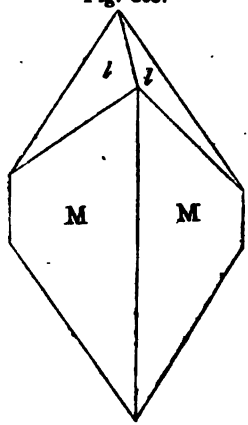
Secondary forms.

Fig. 304.



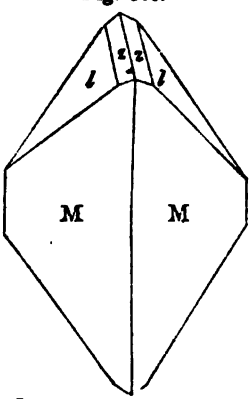
Freiberg, Saxony.
Franconia, (N. H.)

Fig. 305.



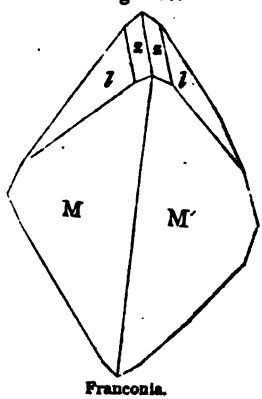
Franconia.

Fig. 306.



Franconia.

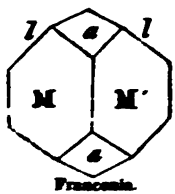
Fig. 307.



Franconia.

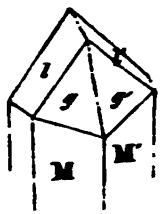
Mispickel.

Fig. 308.



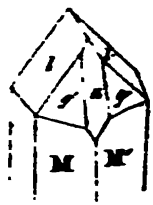
Franconia.

Fig. 309.



Franconia.

Fig. 310.



Franconia.

Fig. 304. *r* on *r* = 145° 26′. (*ditétraèdre.* H.)—Fig. 305. *l* on *l* = 80° 8′. (*unitaire.* H.)—Fig. 306. *z* on *z* = 118° 32′. *l* on *z* = 160° 49′. (*unibinaire.* H.)—Fig. 308. *a* on *a* = 121° 52′. M on *a* = 136° 20′.—Fig. 309. *g* on *g* = 118° 32′. *g* on *l* = 131° 48′.—Fig. 310. *g* on *a* = 149° 16′.

Cleavage, parallel with M and M′ pretty perfect; traces parallel with P. Surface, *r* deeply streaked parallel to its own edges; *g* sometimes rough, or striated in the direction of its edges of combination with *l*; the remaining faces are smooth.

Lustre metallic. Color silver-white, inclining to steel-grey. Streak dark greyish-black.

Brittle. Hardness = 5·5 . . . 6·0. Sp. gr. = 6·127, of a crystallized variety.

Compound Varieties. Twin-crystals: face of composition parallel, axis of revolution perpendicular to a face of M; the composition often taking place parallel to both faces, or being repeated in parallel layers. Massive: composition columnar, individuals of various sizes, generally straight and divergent, or irregular. The faces of composition are irregularly streaked. Individuals joined in a granular com-

position are often very small, or even impalpable and strongly connected; the fracture is uneven.

1. Before the blow-pipe, upon charcoal, it emits copious arsenical fumes, and melts into a globule, which is nearly pure sulphuret of iron. It is soluble in nitric acid, with the exception of a whitish residue.

2. *Analysis.*

By STROMEYER.

Iron	36·04
Arsenic	42·88
Sulphur	21·08

Certain varieties contain a small proportion of silver, and have hence been called *Argentiferous Arsenical Iron.*

3. Mispickel is frequently met with in beds and veins. It is accompanied by ores of silver, lead and tin, and is often attended by Blende.

4. It is common in the mining districts of Saxony; in beds at Breitenbrunn and Raschau; in veins at Freiberg and Munzig, and in tin veins at Altenberg, Geyer and Ehrenfriedersdorf; also in Bohemia, Andreasberg in the Hartz, Tunaberg in Sweden, and Cornwall.

The most interesting deposit of this ore in the U. States, is at Franconia, N.H., where it occurs in gneiss, crystallized in the above forms. It is associated with Yellow Copper Pyrites. A bed of the massive variety exists at Worcester, (Mass.) A similar variety is found at Chatham, (Conn.) along with Copper Nickel; and at Monroe, (Conn.) with Wolfram, Magnetic Iron Pyrites and Native Bismuth.

MOHSITE. Uncleavable Iron-Ore.

Primary form. Rhomboid. P on P $=73^\circ\ 43'$.

Secondary form. Twin-crystals, flattened in a direction perpendicular to the axis, presenting the aspect of small flat tables, nearly circular, with alternate re-entering and salient angles on their edges.

Cleavage not observable.

Lustre metallic. Color iron-black. Opake.

Brittle. Hardness, scratches glass.

1. It is believed to have come from Dauphiny.

MOLYBDATE OF LEAD. (See *Yellow Lead-Ore.*)

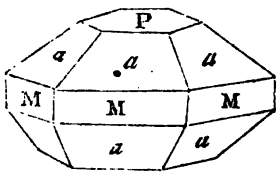
MOLYBDENA-SILVER. (See *Bornite.*)

MOLYBDENITE. Rhombohedral Polypoione-Glance.

Primary form. Regular hexagonal prism.

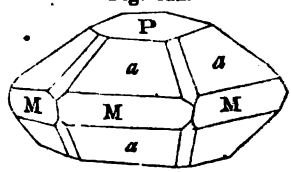
Secondary forms.

Fig. 311.



Haddam, (Conn.)

Fig. 312.



Shutesbury, (Mass.)

Fig. 311. Prmary form, with terminal edges replaced by single planes.—Fig. 312. The same, with the edges between *a* truncated.

Cleavage, parallel with P highly perfect. Fracture not observable. Surface, P smooth; the remaining planes horizontally streaked.

Lustre metallic. Color pure lead-grey. Streak unchanged. Thin laminæ are highly flexible. Very sectile. Hardness =1·0 . . . 1·5. Sp. gr. =4·591.

Compound Varieties. Massive; composition granular, of various sizes of individuals.

1. It does not melt, nor is it reduced before the blow-pipe, but it emits sulphureous fumes, which are deposited on the charcoal. It deflagrates with nitre, and is soluble with effervescence in nitric acid, leaving a grey residue.

2. *Analysis.*

By BUCHOLZ.

Molybdena - - - - -	60 00
Sulphur - - - - -	40·00

3. It is generally found imbedded in granite or gneiss. It is not unfrequently met with in repositories of Tin-Ore, and is accompanied also by Wolfram.

4. Among the oldest known localities of the present species, are Altenberg in Saxony, and Schlaggenwald and Zinnwald in Bohemia. In these places it occurs along with Tin-Ore; in which connexion also, it is found at Cornwall. Other foreign localities are, Norway, Sweden and Scotland.

It is of frequent occurrence in the United States, where it is generally found in gneiss. The most interesting localities are, Haddam and the adjoining towns upon the Connecticut River, where it is found in the quarries of gneiss, in crystals and large plates; at Saybrook it is associated with Stilbite. Other localities are, Shutesbury, (Mass.) and Bowdoin, (Maine.) A very powerful vein of Molybdenite has lately been found at Westmoreland, (Vt.) where it exists in granular masses of considerable size, often free from the intermixture of other minerals. Associated with it are found white crystals of Apatite.

MOLYBDIC OCHRE. Molybdic Lusine-Ore.

Massive: composition impalpable, pulverulent.

Color yellow.

1. Fusible before the blow-pipe, attended with a white smoke. Heated on charcoal, it is partially absorbed, and on powdering and washing the charcoal, grains of the reduced metal are discoverable. With salt of phosphorus, it affords a green glass. It probably consists, when pure, of oxygen 33·39, and molybdenum 66·61; but ordinarily, it contains a portion of the oxide of iron.

2. It is found only in very minute quantities, attending the Molybdenite, at nearly all its localities.

MONAZITE. Tetarto-prismatic Tungstic-Baryte.

Primary form. Doubly oblique prism, giving angles of 49° and 99°.

Lustre vitreous. Color, hyacinth or brick-red. Streak white. Translucent on the edges.

Streak flesh-red.

Hardness = 5·00. Sp. gr. = 4·924.

1. Heated to redness in a glass tube, it suffers no change. In the strongest heat of the blow-pipe, it only melts upon the edges, where it turns to a greenish yellow. Treated with soda or borax, in the reduction flame, it dissolves with effervescence into a light, yellowish, opake mass. Dissolved in the salt of phosphorus, the globule is yellow, while warm; but on cooling becomes yellowish green, and opake. From these and other experiments, it has been inferred that the Monazite is a compound of the oxide of uranium with some one or more of the earths.

2. It is found in the mountains about Ilmensjön in Siberia.

MONOPHANE.

Primary form. Right rhombic prism. M on M = 134° 46′.

Secondary form, the primary having the obtuse angles replaced by singles planes. *t* on *t* (fig. 171) = 111° 56′.

Cleavage perfect, parallel with the shorter diagonal.

Lustre pearly on the cleavage planes, vitreous on the others. Color white.

Hardness (scale of BREITHAUPT) = 6·50 . . . 7·50. Sp. gr. = 2·158 . . . 2·177.

1. Its locality is not mentioned.

MONTICELLITE.

Primary form. Right rhombic prism. M on M = 132° 34′.

Cleavage not observable.

Lustre vitreous. Color yellowish, to colorless. Transparent.

Hardness = 5·0 . . . 7·0.

1. It becomes gelatinous in muriatic acid, and is difficult to fuse before the blow-pipe.

2. It is found with Mica and Pyroxene, in limestone, among the ejected matters of Vesuvius.

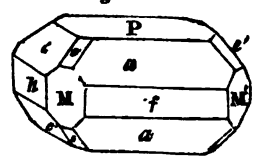
MOROXITE. (See *Apatite*.)

MULLERITE. Auro-tellurium Melacone-Metal.

Primary form. Right rhombic prism. M on M = 105° 30′.

Secondary form.

Fig. 313.



P on M or *f*	- -	90°	00′
M on *f*	- -	142	30
M on *h*	- -	127	30
a on *f*	- -	161	30
c on *h*	- -	126	55
c on *a*	- -	123	30

Imbedded crystalline laminæ. Traces of cleavage. Fracture uneven.

Lustre metallic. Color silver-white, merely inclining to brass-yellow. Opake.

Rather brittle. Soft. Sp. gr.=10·678. MULLER.

1. Before the blow-pipe, it melts into a metallic globule, and emits a pungent odor. It is soluble in nitric acid.

2. *Analysis.*
By KLAPROTH.

Tellurium - - - - -	44·75
Gold - - - - -	26·75
Lead - - - - -	19·50
Silver - - - - -	8·50
Sulphur - - - - -	0·50

3. It has been found only at Nagyag in Transylvania, where it attends Graphic Gold and Manganblende.

MURCHISONITE. (See *Feldspar.*)

MURIACITE. (See *Anhydrite.*)

MURIATE OF AMMONIA. (See *Sal-Ammoniac.*)

MURIATE OF COPPER. (See *Atacamite.*)

MURIATE OF MERCURY. (See *Horn Quicksilver.*)

MURIATE OF SILVER. (See *Horn Silver.*)

MURIATE OF SODA. (See *Common Salt.*)

MURIATIC ACID. Muriatic-Acid Gas. MOHS.

Gaseous. Transparent, when unmixed with atmospheric-air.

Sp. gr. =1·278. BERZ. 1·284. MOHS.
Odor pungent. Taste strongly acid.

1. Muriatic-acid gas consists of

Muriatic acid - - - -	75·31
Water - - - -	24·69.

BERZELIUS: (and Muriatic-acid is composed of chlorine and hydrogen, united in equal volumes.) It produces white fumes in the atmosphere, powerfully reddens vegetable blues, extinguishes combustion, and is fatal to life. At the temperature of 40° Fahr., water absorbs about 480 times its bulk of this gas. Under a pressure of 50 atmospheres, FARADAY converted it into a colorless fluid.

2. It is found in the crevices and craters of active volcanoes, as those of Etna, Vesuvius and Hawaii. It is also said to be produced by stagnant waters in salt-mines.

3. When obtained artificially from the decomposition of common salt, it is employed as a disinfecting agent, and to form the muriate of tin. Dissolved in water, it forms the common muriatic acid of commerce, which, mingled with nitric acid, constitutes the *aqua regia*, by which gold and platinum are dissolved.

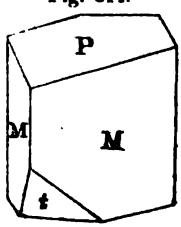
MURIO-CARBONATE OF LEAD. (See *Corneous Lead.*)
MUSSITE. (See *Pyroxene.*)

MYARGYRITE. Hemi-prismatic Melacone-Blende.

Primary form. Oblique rhombic prism. M on M′ = 86° 4′. P on M=101° 6′.

Secondary form.

Fig. 314.



Myargyrite.

The crystals contain many secondary faces, and have on the whole much the appearance of crystals of Copperas.

Cleavage, parallel with M, imperfect. Fracture imperfectly conchoidal. Surface, M deeply streaked parallel to the longer diagonal, P horizontally.

Lustre intermediate between metallic and metallic adamantine. Color iron-black. Streak dark cherry-red. Opake, except in thin splinters, where it transmits a deep, blood-red color.

Very sectile. Hardness = 2·0 . . . 2·5. Sp. gr. = 5·234.

1. Before the blow-pipe, it gives results nearly agreeing with those of Red Silver-Ore.

2. *Analysis.*

By Rose.

Sulphur	21·95
Antimony	29·11
Silver	36·40
Copper	1·06
Iron	0·62

3. This extremely rare mineral has hitherto been found only in a few single crystals, at Braunsdorf, near Freiberg in Saxony.

Mysorine.

Massive: composition impalpable. Fracture small conchoidal. Color brownish-black, sometimes with a tinge of green and red. Tender. Sp. gr. = 2·620.

1. It is soluble in the acids, unless when it contains foreign matters; in which case the solution deposits a reddish precipitate.

2. *Analysis.*

By Thomson.

Carbonic acid	16·70
Deutoxide of copper	60·75
Peroxide of iron	19·50
Silica	2·10

3. It is found in the peninsula of Hindostan, near the eastern frontier of Mysore. It forms beds in the older rocks.

4. It has been observed that the Malachites, on being subjected to calcination, afford a substance analogous to the Mysorine.

NACRITE. (See *Talc.*)

NAPHTHA. (See *Bitumen.*)

NAPHTHALINE.

Crystallized in irregular, undetermined octahedra.

Cleavage, in more than one direction. Fracture conchoidal.

Lustre adamantine to resinous. Color white, green or yellow. Transparent.

Brittle. Rather heavier than water.

1. Fuses at low temperatures, and crystallizes on cooling. It readily burns with a bright flame and much smoke.

2. It is found in the fissures and fractures of bituminous wood, which it sometimes traverses, and into which it seems to have been introduced by sublimation. The layer of lignite belongs to a very recent formation, containing fossil vegetables, analogous to those now existing.

3. It is found in the coal formation of Uznach.

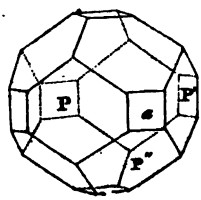
NAPOLITE. (See *Sodalite.*)

NATIVE AMALGAM. Argento-Mercury Melacone Metal.

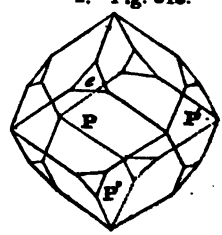
Primary form. Rhombic dodecahedron.

Secondary forms.

1. Fig. 315.



2. Fig. 316.

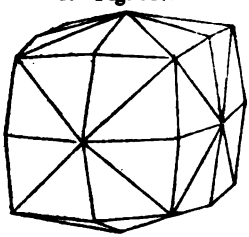


Native Amalgam.

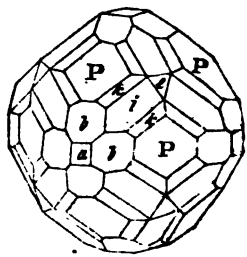
3. Regular octahedron.

4. Trapezohedron.

5. Fig. 317.



6. Fig. 318.



P on *a*	-	-	-	135° 00′	PHILLIPS.
P on *b*	-	-	-	154 00	"
P on *i*	-	-	-	150 00	"
P on *k*	-	-	-	160 40	"
a on *b*	-	-	-	161 2	"
i on *k*	-	-	-	169 5	"

Cleavage, very indistinct traces parallel to the dodecahedron. Fracture conchoidal, uneven. Surface smooth and shining.

Lustre metallic. Color silver-white. Streak unchanged.

Brittle; it emits a grating noise when cut with a knife. Hardness = 3·0 . . . 3·5. Sp. gr. = 13·755.

Compound Varieties. Massive: individuals scarcely discernible, fracture conchoidal, uneven.

1. Two kinds of Native Amalgam have been distinguished, in reference to the solid or fluid state in which it is found. The fluid varieties must be considered as solutions of the solid ones in fluid mercury.

2. Before the blow-pipe, the mercury is driven off, and a globule of pure silver is obtained.

3. *Analysis.*

	By KLAPROTH.	By CORDIER.
Silver	34·8	27·50
Mercury	65·2	72·50

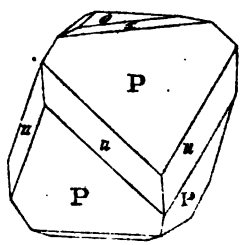
4. It is found accompanied by other ores of silver and mercury, and by Iron Pyrites, at Moschellandsberg in the Palatinate, and at Rosenau in Hungary. It is said also to have been met with in France, Spain and Sweden.

NATIVE ANTIMONY. Antimony Melacone Metal.

Primary form. Rhomboid. P on P = 117° 15′.

Secondary form.

Fig. 319.



Cleavage, parallel with *o* highly perfect, and possessing a strong lustre; parallel with P distinct, and easily obtained, but showing a less degree of lustre; parallel with *x*, obtained with difficulty, and interrupted; faint traces parallel with *u*. The surface of *o* is triangularly streaked, of P in a horizontal direction, and parallel with its edges. Fracture not observable.

Lustre metallic. Color tin-white. Streak unchanged. Rather brittle. Hardness = 3·0 . . . 3·5. Sp. gr. = 6·646, the Swedish variety.

Compound Varieties. Reniform; surface reniform or uneven; composition of flat grains collected into curved or lamellar. Massive; composition granular, of various sizes of individuals, easily separated; faces of composition striated agreeably to the faces of cleavage.

1. Before the blow-pipe, it melts quickly into a globule, and continues to burn when heated to redness, even if the blast is suspended. It emits copious white fumes, which are deposited round the globule: first yellowish-white octahedrons, probably of antimonious acid, are formed, and then snow-white prismatic crystals of oxide of antimony, with which at last, the whole globule is covered. Some of the varieties leave a globule of silver when the contents of antimony have been entirely volatilized. It crystallizes readily from fusion.

2. *Analysis.*

By KLAPROTH.

Antimony	98·00
Silver	1·00
Iron	0·25

3. Native Antimony is found in veins traversing ancient rocks, and is principally accompanied by other species that contain antimony. The *Antimony Ochre*, which occurs with it, seems to be the product of its decomposition.

4. The present species was first discovered at Suhlberg, near Sahla in Sweden, and afterwards at Allemont in Dauphiny, where it occurs in curved lamellar compound varieties, which consist of granular ones, and at Andreasberg in the Hartz. It is likewise found in primitive mountains, attended by Grey Antimony and Galena; at San Han Huetamo, and Cuencamé, in Mexico.

NATIVE ARSENIC. Arsenic Melacone-Metal.

Primary form. Rhomboid. P on P=114° 26′.

Cleavage, imperfect, parallel with P.

Lustre metallic. Color tin-white, a little inclining to lead-grey, very soon tarnished dark-grey on being exposed to the air. Streak unchanged, rather shining.

Brittle. Hardness = 3·5. Sp. gr. = 5·766, a Saxon variety.

Compound Varieties. Reticulated, reniform and stalactitic shapes; composition granular, small and often impalpable; it is sometimes columnar, forming a second curved lamellar composition; the individuals being generally impalpable, and the faces of the second composition reniform or uneven. In columnar particles of composition, a cleavage in a direction perpendicular to the axis of the individuals, is observed.

1. Upon ignited charcoal, or before the blow-pipe, it emits a strong garlic smell, and copious white fumes; and at last disappears altogether. It is the volatilized metal, and not the white fumes of arsenious acid, which possess the odor of garlic.

2. *Analysis.*

By John.

Arsenic	96·00	97·00
Antimony	3·00	2·00
Oxide of iron and water	1·00	1·00

3. It is not uncommon in several of the mines of Annaberg, Schneeberg, Marienberg and Freiberg in Saxony; also at Joachimsthal in Bohemia, at Andreasberg in the Hartz, in the Black Forest, in Alsace at Allemont in Dauphiny, at Kongsberg in Norway, at Kapnik in Transylvania, and in beds at Orawitza in the Bannat of Temeswar.

4. It is variously employed in metallurgical processes; it enters into the composition of certain kinds of glass, and of many colors, and has been introduced even among the pharmaceutical preparations. It is a violent poison.

NATIVE BISMUTH. Bismuth Melacone-Metal.

Primary form. Regular octahedron.

Secondary form. Rhombic dodecahedron.

Cleavage, octahedral, perfect. Fracture not observable. Surface rough, often covered with Bismuth-Ochre.

Lustre metallic. Color silver-white, much inclined to red, subject to tarnish. Streak unchanged.

Sectile, almost malleable. Hardness=2·0 . . . 2·5. Sp. gr.=9·737.

Compound Varieties. Imbedded, feathery and arborescent shapes. Massive: composition granular, individuals very distinct, though small.

1. When heated before the blow-pipe, it is volatilized, and leaves a yellow coating upon the charcoal. It is soluble in nitric acid, but the solution yields a white precipitate, if farther diluted. It crystallizes in cubes from fusion.

2. It commonly occurs in veins in gneiss and clay-slate, and is accompanied by ores of silver, cobalt, tin, &c.

3. Its chief localities are several of the Saxon and Bohemian silver and cobalt mines at Schneeberg, Annaberg, Marienberg, Johanngeorgenstadt, Joachimsthal, &c. It occurs at Fahlun in Sweden, Modum in Norway, in France and England.

Its only known locality in the U. States, is Monroe, (Conn.) where it occurs in a bed of Quartz, associated with Wolfram, Tungsten, Galena, Blende, &c..

NATIVE COPPER. Copper Melacone-Metal.

Primary form. Cube.

Secondary forms.

1.
Primary form, with angles truncated.
Cornwall.

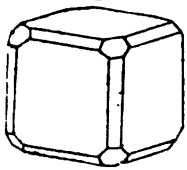
2.
Octahedron.
Cornwall.

3.
Cube, with edges truncated.
Siberia.

4.
Dodecahedron.
Cornwall.

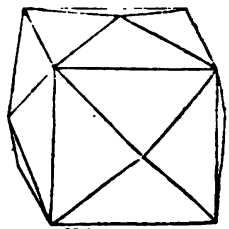
Native Copper.

5. Fig. 320.



Siberia.

6. Fig. 321.



Nahoe.

Cleavage, none. Fracture hackly. Surface generally not very smooth, but nearly of the same quality in all the forms, excepting the dodecahedron, which is sometimes streaked parallel to its edges of combination with the cube. It is subject to tarnish.

Lustre metallic. Color copper-red. Streak unchanged, shining.

Ductile. Hardness $=2{\cdot}5\ldots3{\cdot}0$. Sp. gr. $=8{\cdot}5844$.

Compound Varieties. Twin-crystals very frequent, composed parallel to a face of the octahedron. If the form of the individuals is the icositetrahedron, and the compound crystal flattened in the direction of the axis of revolution, isosceles six-sided pyramids are formed, which at first sight appear incapable of derivation from the cube. Small crystals aggregated in rows; arborescent and filiform shapes. Massive: composition not recognizable. Plates, often consisting of distinct crystals. Superficial.

1. Before the blow-pipe, it melts pretty easily, but on cooling is covered with an oxidized coat. It is easily soluble in nitric acid, and yields under the influence of light and air, a blue solution in ammonia. It crystallizes from fusion. Dentiform and capillary crystals are often produced in the vesicular cavities of copper slags.

2. It is found in beds and veins, and is associated with various other ores of copper, and sometimes with ores of iron; also loose in the soil, and in water-worn fragments.

3. Native Copper has been more frequently met with, than any of the other metals in their native state. It occurs in beds at Herrengrund, Schmölnitz, and Göllrietz; also at Moldawa, Saska and Orawitza, in the Bannat of Temeswar; probably in the same manner in Siberia, from whence the largest and most distinct crystals of the general shape of the cube have been brought, engaged in granular limestone. It occurs likewise in beds, in bituminous marl-slate, at Camsdorf in Thuringia, and in the county of Mansfield, and in Chessy near Lyons. In veins, it is met with in considerable quantities, in many of the mines near Redruth in Cornwall. Native Copper, crystallized in beautiful icositetrahedrons, occurs in amygdoloid, accompanied by Chabasie, in Nelsoe, one of the Faroe islands. Native Copper has often been found in detached masses, throughout North America, particularly in Illinois, Michigan, and the North Western Territory. About thirty miles south from Lake Superior, on the west bank of the river Ontanawgaw, exists a serpentine rock, thickly interspersed with this species.* It has particularly abounded throughout the greenstone trap and red sandstone formation of Massachusetts, Connecticut and New Jersey; having been found at Schuyler's mine, (N.Jersey,) at Bristol, near New Haven, (Conn.) and at Deerfield, (Mass.)

What has been called *copper of cementation*, is the metal precipitated from its solution in sulphuric acid by metallic iron. It is produced at Herrengrund and Schmölnitz in Hungary, and in Cornwall.

4. Copper, in its uses, is too well known to require an enumeration of them.

NATIVE GOLD. Gold Melacone-Metal.

Primary form. Regular octahedron.

Secondary forms.

1.	2.
Primary, with angles truncated.	Cube.
Matto Grosso, Brazil.	Transylvania.

* The cabinet of Yale College contains a piece from this river, which weighs 137 pounds. A single mass, believed to weigh a ton, still occupies the bed of the river.

Native Gold.

3.

Cube, with edges truncated.

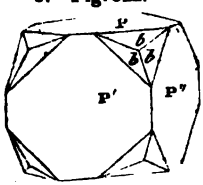
Siberia.

4.

Dodecahedron.

Transylvania.

5. Fig. 322.



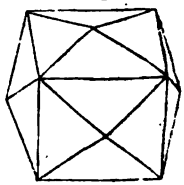
Siebenburgen.

6.

Trapezohedron.

Siebenburgen.

7. Fig. 323.



Siberia.

Cleavage, none. Fracture hackly; the cube often hollow; the octahedrons either rough or smooth, in combinations, generally the latter; the icositetrahedrons streaked parallel to the edges of combination with the cube and the octahedron. These differences in most cases are not distinctly marked.

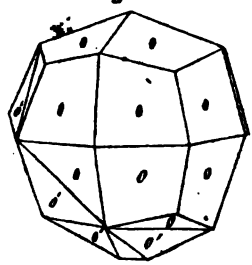
Lustre metallic. Color, various shades of gold-yellow. Streak shining.

Ductile. Hardness = 2·5 . . . 3·0. Sp. gr. = 14·857, a rolled mass of a high gold-yellow color; 19·2527, melted, Hauy.

Compound Varieties. Twin-crystals; face of composition parallel, axis of revolution perpendicular, to a face of the octahedron; pretty frequent, particularly in the icositetrahedrons, as represented in

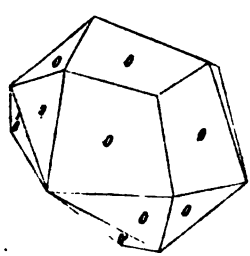
Native Gold.

Fig. 324.



If this variety be compressed in the direction of the axis of revolution,

Fig. 325



is formed. Filiform, capillary, reticulated, and arborescent shapes; also leaves and membranes. Sometimes the individuals are still discernible. Surface drusy, striated or smooth. Massive: composition not observable, fracture hackly. Plates, superficial coatings, rolled masses.

1. Native Gold melts pretty easily, and is soluble only in chlorine, or nitro-muriatic acid. Gold may be obtained crystallized, from fusion. A solution of muriate of gold in sulphuric ether, yields cubic crystals on evaporation. Brilliant crystals of the compound form of the cube, octahedron and dodecahedron, have been accidentally formed by exposing for several years an amalgam of gold wrapt up in cotton.

Native Gold.

2. *Analysis.*

	By LAMPADIUS.	By ROSE.	By BOUSSINGAULT.	
	A brass-yellow colored variety.	fr. Siberia.	fr. Santa Rosa.	fr. Trinidad.
Gold	96·60	99·34	64·93	82·40
Silver	2·00	0·14	35.07	17·60
Iron	1·10	0.00	0·00	0·00

3. Native Gold is so minutely disseminated in several rocks, that its presence can be discovered only after pounding and washing. It occurs frequently in beds, in small nodules imbedded in Quartz, along with Iron Pyrites, Grey Antimony and Wolfram: rarely also, it is found in crystals in these situations: in veins also, with the same minerals, and with Blende, Calcareous Spar, Native Silver, &c. Native Gold is often found in the sand of rivers, in valleys and plains, into which it has been carried from its original repositories, in the shape of larger or smaller, generally, flat pebbles, often mixed with Quartz.

The most extensive deposits of Native Gold occur in alluvial soil in Brazil, Mexico and Peru: also in Transylvania, a considerable quantity of gold is obtained from stream-works. At Wicklow in Ireland, and in Perthshire, and near the Lead Hills in Scotland, in several districts of Germany, gold is found in the sand of rivers, or in alluvial deposits from them. The mountain of Vöröspatak near Alrudbanya in Transylvania, is a remarkable instance of a rock impregnated throughout with a small portion of gold, which occurs crystallized, and in various imitative shapes, in the numerous short and narrow veins which traverse it in all directions. This mountain consists of a kind of greywacke and porphyry. In a similar rock it is found at Salzburg, and many other places along the chain of the Alps, and in the Schlangenberg in Siberia. At Offenbanya in Lower Hungary, it is accompanied by Grey Antimony; and at Zalathna and Nagyag, by Native Tellurium.

Native Gold, unknown within the U. States, until within a very few years, has now been traced from the Chaudière river in Lower Canada, to the southern boundary of the Cherokee nation in Georgia; and it is known to exist in a nearly unbroken line, from the Rappahannock in Virginia, to the Coosa in Alabama. The most important mines in this extensive range, are those situated in the Carolinas and Georgia. The mines of North Carolina are chiefly wrought in the three ranges of counties between Frederic and Charlotte, which lie in a direction about N. E. and S. W., corresponding with the general line of the coast. The Mecklenburg mines are the most valuable, and are for the most part

vein deposits; those of Burke, Lincoln, and Rutherford, are mostly alluvial mines. A single mass of Native Gold was found in Cabarras county that weighed twenty-eight pounds.* Several vein mines in the neighborhood of Fredericksburg, (Va.) have afforded fine specimens of Native Gold, traversing white Quartz.

NATIVE IRIDIUM. Iridium Sclerone-Metal.

Primary form. Rhomboid.

Secondary form. Six-sided prism, combined with two isosceles six-sided pyramids.

Cleavage, perpendicular to the axis. Grains.

Lustre metallic. Color pale steel-grey. Opake.

Brittle. Harder than Platina. Sp. gr. =19·5. WOLLASTON.

1. If melted with nitre, it becomes black; but again acquires both its color and lustre, if heated with charcoal. It is not dissolved by nitro-muriatic acid. It is an alloy of iridium and osmium.
2. It occurs in South America, accompanied with Native Platina.

NATIVE IRON. Iron Sclerone-Metal.

Primary form. Regular octahedron.

Cleavage, visible, parallel with the primary form, the crystal being traversed by natural joints, separating it into laminæ, which project and recede, so as to leave oblique angled cavities of greater or less extent on all the faces. The crystal is partially oxidated upon the outside, and between the laminæ. Fracture hackly.

Lustre metallic. Color iron-grey. Streak shining. Strong action on the magnet.

* The stream-mines of the U. States, have yielded about $6,000,000. Three deposit mines in Georgia have afforded $500,000.

Native Iron.

Ductile. Hardness=4·5. Sp. gr. =7·318, a partially oxidated fragment of the crystal from Guilford co. (N. C.)

Compound Varieties. Massive: composition not observable, excepting where it is traversed by Plumbago; in which case it separates into irregular, oblique tetrahedrons. Sp. gr.=6·72, much intermingled with Plumbago, from Canaan, (Conn.)

1. *Analysis.*

	By Klaproth. fr. Ramsdorf.	By Godon de St. Memin. fr. La Bowiche.	By Shepard. fr. Canaan.
Iron	92·50	94·50	91·80
Lead	6·00	0 00	0·00
Copper	1·50	0 00	0 00
Carbon	0·00	4·00 mechanically mixed	7·00
Phosphoric acid	0·00	1·20	0·00

2. It is not perfectly certain that the Native Iron of Kamsdorf, in Saxony, is of terrestrial origin, though it is said to have occurred in a mass of Limonite, associated with Spathic Iron and Heavy Spar. Other localities mentioned in Saxony, are Steinbach and Eibestock; at the former it is attended by brown Garnet, and at the latter, it is in a vein. A stalactitic mass, covered by fibrous Limonite and Quartz, was met with in a vein traversing the mountain of gneiss called Oulle, near Grenoble in France. The *Native Steel*, from La Bowiche in France, engaged in an iron slag, appears to be of a secondary formation, owing to the combustion of a coal seam.

The United States have afforded examples of Native Iron, of the most incontestibly terrestrial origin. The variety from Canaan, (Conn.) was found attached in the form of a vein or plate, two inches thick, to a mass of mica-slate rock, upon a primitive mountain; that from Guildford co. (North Carolina) consists of a single octahedral crystal, weighing about seven ounces, which is reported to have been detached from a mass that weighed twenty-eight pounds, and which was wrought into nails, by a black-smith.*

* The American specimens of Native Iron, here alluded to, are in the cabinet of Yale College.

3. Native Iron, alloyed with Nickel and other metals, forms large meteoric masses, and enters into the composition of meteoric stones. But as these bodies are regarded as extra-terrestrial in their origin, it will not be proper to describe them in the present work.

NATIVE LEAD. Lead Melacone-Metal.

Massive. Fracture hackly.

Lustre metallic. Color pure lead-grey. Streak shining. Malleable and ductile. Hardness = 1·5. Sp. gr. = 11·3523. Disagreeable odor by friction.

1. Before the blow-pipe, it melts easily, and is gradually dissipated in fumes, leaving a yellow powder upon the charcoal.

2. The localities generally quoted of this species, afford it under circumstances, rendering it highly probable that it has been reduced from Galena by heat. Thus, at the island of Madeira it is imbedded in vesicular masses, considered as slags by some, and a volcanic rock by others; and at Alston in Cumberland, associated with Galena Quartz, Minium, and a fused mass resembling slag. But an undoubted deposit of Native Lead exists in Michigan, at Anglaise river, where it occurs in extremely delicate membranes, between the cleavages of galena; existing, however, only in sufficient quantity to increase the sp. gr. of the Galena to 7·88.

NATIVE MAGNESIA. Rhombohedral Gypsum-Mica.

Primary form. Rhomboid.

Secondary form. Low six-sided prisms, rare.

Massive: composition lamellar, broad columnar, the latter sometimes stellular.

Cleavage, in one direction perfect.

Lustre pearly upon the cleavage face. Color white, inclining to green, grey and blue. Streak white. Translucent, sometimes only on the edges. Some varieties lose their transparency on being exposed to the air.

Sectile. Thin laminæ flexible. Hardness=1·0...1·5. Sp. gr.=2·350, the variety from Unst.

1. Before the blow-pipe, it loses its transparency and weight, and becomes friable. In acids, it is dissolved with effervescence.

2. *Analysis.*

	By Bruce.	By Fyfe.
Magnesia	70·00	69·75
Water	30·00	30·25

3. It occurs at Swinaness, one of the Shetland Islands, in small seams, in serpentine; but more abundantly at Hoboken, (N. J.) opposite New York city; the veins at this place are sometimes one inch in thickness.

NATIVE MERCURY. Mercury Melacone-Metal.

Amorphous. Liquid.

Lustre metallic. Color tin-white.

Hardness=0·0. Sp. gr.=13·581. Hauy.

1. Fluid mercury is the pure metal, as produced by nature. It is entirely volatile before the blow-pipe, and easily soluble in nitric acid.

2. Like Native Amalgam, it occurs with Cinnabar in the shape of small globules or drops, and sometimes in narrow fissures of those rocks which contain the Cinnabar.

3. The most important and well known localities of Native Mercury, are Idria in Carniola, and Almaden in Spain. In smaller quantities, it is found at Wolfstein and Mörsfeld in the Palatinate, also in some places in Carinthia, in Hungary, in Peru, and other countries.

4. The quantity of Mercury found native is too small, to allow of its being applied to any useful purpose.

NATIVE PALLADIUM. Palladium Sclerone-Metal.

Primary form. Regular octahedron.

Grains.

Lustre metallic. Color steel-grey, inclining to silver white.

Hardness =4·5 . . . 5·0. Sp. gr. =11·8, WOLLASTON; =12·14, LOWRY.

1. It is reducible by heat. Alone, before the blow-pipe, it is infusible; but with sulphur, it melts. With nitric acid, it yields a red solution.

It consists essentially of palladium, but contains also a small proportion of iridium and platina.

It occurs intermingled with Native Platina, in Brazil.

NATIVE PLATINA. Platina Sclerone-Metal.

Primary form. Cube.

Irregular forms and grains. Surface uneven, sometimes worn off by attrition, (pebbles.)

Cleavage, none. Fracture hackly.

Lustre metallic. Color perfect steel-grey. Streak unchanged, shining.

Ductile. Hardness = 4·0 . . . 4·5. Sp. gr. = 17·332, rolled masses.

1. It is very refractory, and soluble only in nitro-muriatic acid.

2. *Analysis.*

By BERZELIUS.

	fr. Nischne-Taguilsk.	fr. Goroblagodat.	fr. the Ural.
Platina	78·94	73·58	86·50	84 30
Iridium	4·77	2·35	0·00	1·46
Rhodium	0·86	1·15	1·15	3·46
Palladium	0 28	0·30	1·10	1·06
Iron	11 04	12·98	8·32	5 31
Copper	0·70	5 20	0·45	0·74
Osmium and iridium	1·96	2·30	1·40	1·03 osmium.
Earthy substances	0·00		0·00	0·72

3. The original repositories of Native Platina are not known, it having hitherto been found only in pebbles and grains, generally small, but sometimes upwards of a pound and a half in weight. It is accompanied by Zircon and some other gems; also by Magnetic Iron, Native Gold, and Native Iridium and Palladium.

4. It has been chiefly brought from the provinces of Choco and Barbacoas in South America, also from Matto-Grosso in Brazil. It has also been found in St. Domingo, and in Siberia. In the mine of Nischne-Taguilsk, (which is also rich in gold, Irid-osmium, Rutile, and even contains Diamonds,) several large masses of Native Platina have been found, weighing from seven to fifteen pounds. M. SCHWETZAW describes two varieties in the Russian Platina from Nijnotaguilsk in the government of Perme. 1. *Common Platina.* Color platina-grey. Grains angular and bristled, seldom blunt edged; also in cubical crystals and grouped. Hardness = Hornblende. Malleable. Sp. gr. = 17 ... 17·62. *Ferruginous Platina.* Color darker than the preceding. Surface tarnished, sometimes like meteoric iron. Grains and crystals have the same form as common Native Platina. Hardness = Feldspar, and rather higher. Less malleable than the first. Sp. gr. = 14·6 ... 15·7. It is magnetic, and in some grains not only attracts, but repels. It contains a large proportion of iron.

5. The refractory powers of this metal, and the circumstance that it is not acted upon by the greater part of the chemical re-agents, render it extremely valuable in the construction of philosophical and chemical apparatus. It is used also for covering other metals, for painting on porcelain, for coin, and like gold and silver, for various other purposes.

NATIVE SILVER. Silver Melacone-Metal.

Primary form. Cube.

Secondary forms.

1. Cube, with angles truncated.
2. Regular octahedron. Mexico.
3. Trapezohedron. Kongsberg.

Cleavage, none. Fracture, hackly. Surface, the octahedron striated in a triangular direction, parallel to its edges of combination with the cube. The remaining faces often rough, but even.

Lustre metallic. Color silver-white, more or less subject to tarnish. Streak shining.

Native Silver.

Ductile. Hardness =2·5 . . . 3·0. Sp. gr. =10·4743, HAUY.

Compound Varieties. Twin-crystals; compound, parallel to one of the faces of the octahedron. Dentiform, filiform and capillary shapes, also reticulated, arborescent and in plates. Often the individuals are still discernible, but frequently also their extent can be no longer ascertained. In the latter case, the surface of the dentiform and filiform shapes is longitudinally streaked. Massive: composition rarely observable, fracture hackly. Plates formed in fissures, also superficial coatings.

1. Native Silver has been divided into *common* and *auriferous* Native Silver. It is at present impossible to decide, whether the latter ought to be united as a variety with the former, or whether it forms a species of its own, as we are not yet sufficiently acquainted with all its physical properties, by which alone this question can be decided. Specific gravity, and the yellowish color, form the distinctive marks between them; but as these may arise from the mere juxtaposition of the two metals, they are not alone sufficient for the purpose.

2. Native Silver is soluble in cold nitric acid, but in the sulphuric acid, only with the assistance of heat. It crystallizes from fusion before the blow-pipe, if the globule is not too large,—forming while crystallizing, a single individual, in which the faces of the octahedron, the cube and the dodecahedron, are distinctly seen.

3. *Analysis.*

The common varieties present the silver pure as produced by nature, occasionally alloyed with a small proportion of antimony, arsenic, iron, &c. A variety of auriferous Native Silver yielded to KLAPROTH, and another to FORDYCE, the following ingredients:

Silver	-	-	-	36·00	-	-	-	72·00
Gold	-	-	-	54·00	-	-	-	28·00

4. Native Silver occurs principally in veins, traversing gneiss, clay-slate, and other primitive and transition rocks. It is accompanied by numerous species of Pyrites, Glance and Blende, as well as by Quartz, Calcareous Spar, &c. The auriferous Native Silver, though it is found

in the same repositories, is far more scarce. The formation of *Black Silver*, a black, friable substance, which is very rich in silver, seems to depend chiefly upon the presence of Native Silver.

5. Native Silver is found in the mining districts of Saxony and Bohemia, also in Norway and Siberia, but particularly in Mexico and Peru. Native Silver is also found in Cornwall and in Siberia. No well authenticated locality exists in the U. States.

6. The employment of silver in coinage, and in the manufacture of plate and articles of luxury, is well known.

NATIVE TELLURIUM. Tellurium Melacone-Metal.

Primary form. Rhomboid. P on P=115° 12′.

Secondary form. Hexagonal prism, with the terminal edges replaced by single planes, the secondary planes inclining to the lateral faces at 147° 36′.

Cleavage, parallel with the primary form, but very obscure.

Lustre metallic. Color tin-white. Streak unchanged. Rather brittle. Hardness = 2·0 . . . 2·5. Sp. gr. = 6·115. KLAPROTH.

Compound Varieties. Massive: composition distinctly granular, individuals small; sometimes a tendency to columnar composition.

1. It melts upon charcoal with ease before the blow-pipe, burning with a greenish flame, and emitting the odor of horse-radish, which however is owing to the presence of a small quantity of selenium.

2. *Analysis.*

By KLAPROTH.

Tellurium - - - - -	92·55
Iron - - - - -	7·00
Gold - - - - -	0·25

3. The Native Tellurium occurs in sandstone, probably in beds, or in veins of a contemporaneous origin with the rock. It is accompanied by Quartz and Iron Pyrites, as well as by Native Gold.

Natron.

4. It has been found in the mine of Maria Loretto at Faceberg, near Zalathna in Transylvania. It was melted to extract the gold, but has now become very scarce.

NATROLITE. (See *Mesotype.*)

NATRON. Hemi-prismatic Natron-Salt. MOHS.

In imitative shapes: composition columnar. Massive: composition granular. Commonly occurring in the state of powder, or efflorescent crusts.

Lustre vitreous on the fresh fracture. Color white, the grey and yellow tints are owing to foreign admixtures. Streak white. Semi-transparent.

Sectile. Hardness =1·0 . . . 1·5. Sp. gr. = 1·423.

Taste pungent, alkaline.

1. It is very soluble in water, effloresces with acids, and melts before the blow-pipe. Blue vegetable colors are changed by it to green.

2. *Analysis.*

By BEUDANT.

	from Debreezen.	from Egypt.
Carbonic acid	30·40	30 90
Soda	43·20	43·80
Water	13·80	13·50
Sulphate of soda	10·40	7·30
Chloride of sodium	2·20	3·10
Earthy matter	0·00	1·40

3. This salt loses its water on being exposed to a dry atmosphere, and is therefore commonly met with in the state of an efflorescent powder on the surface of the earth, on the shores of lakes, or in natural caverns. It is held in solution by certain mineral waters. According to BERTHOLET, it is formed in part by a decomposition of common salt by carbonate of lime.

4. It occurs in considerable quantities in the plains of Debreezen, in Hungary; also in Bohemia, Italy and several other European countries, but principally in the soda lakes of Egypt, and in some parts of Asia and South America.

5. Its chief employment is in the manufacture of soap. It enters also into the composition of glass, and is used in dyeing, washing, bleaching, &c., both in the natural state, and purified by the assistance of chemical processes.

NATROSIDERITE. (See *Achmite.*)

NECRONITE. (See *Feldspar.*)

NEEDLE-ORE. (See *Cupreous Bismuth.*)

NEEDLE-STONE. (See *Mesotype.*)

NEMALITE. Nemaline Atelene Picrosmine.

Massive; composition thin columnar; fibres parallel, slightly curved.

Lustre pearly. Color greyish, and bluish white. Translucent.

Fibres elastic. Hardness = 2·0 . . . 2·5. Sp. gr. = 2·30 . . . 2·44.

1. The fibres, when held in the flame of a lamp, become opake and rigid; and on being subjected to the heat of the blow-pipe, they become friable, at the same time changing to a light brown color. Soluble in acids, without effervescence.

2. *Analysis.*
By THOMSON.

Magnesia - - - - -	51·721
Silica - - - - -	12·568
Peroxide of iron - - - -	5·874
Water - - - - -	29·666

3. It occurs in veins, traversing serpentine, at Hoboken, (N. J.)

NEOPLASE. (See *Botryogene.*)

NEOTESENE.

Primary form. Right square prism?
Color green.

1. It yields moisture on being heated, and passes to a yellow color. In a higher temperature, it scarcely gives any odor of arsenic. It im-

parts to the fluxes the color of the oxides of iron, affording at the same time a strong smell of arsenic.

2. *Analysis.*

By BERZELIUS.

Arsenic acid - - - - -	50·80
Peroxide of iron - - - -	23·00
Protoxide of iron - - - -	10·38
Water - - - - - -	15·87

3. It is found in Brazil, near Villa-Rica, where it exists in cavities of Limonite.

4. It is doubtful whether this mineral can with propriety be distinguished from Cube-Ore.

NEPHELINE. Rhombohedral Feldspar. MOHS.

Primary form. Regular hexagonal prism.

Secondary forms.

Fig. 326.

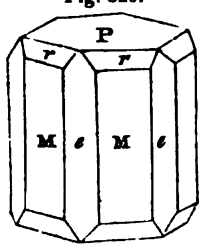
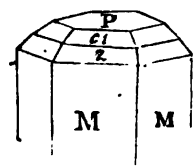


Fig. 327.



P on c 1 - - -	151° 53′	HAUY.
P on c 2 - - -	135 40	PHILLIPS.

Cleavage, parallel with M and P, both imperfect.

Fracture conchoidal. Surface smooth and even.

Lustre vitreous to resinous. Color white. Streak white. Transparent . . . translucent.

Brittle. Hardness = 6·0. Sp. gr. = 2·56.

Compound Varieties. Massive: composition granular, of various sizes of individuals. Faces of composition

rather rough. The variety Elaolite possesses a dark-blue color, passing into green, grey and brown.

1. The old species *Elaolite* appears to be, with justice, incorporated with Nepheline, on account of their resemblance in hardness and specific gravity. The *Cavolinite* and *Davyne*, also, fall within the present species, differing from it only in a somewhat diminished specific gravity, and in the surface of the crystals. The sp. gr. of the former is 2·1: its crystals are opake, and possessed of a pearly lustre,—that of the latter = 2·25 . . . 2·3, with surfaces of crystals which are dull.

2. Before the blowpipe, upon charcoal, its edges are rounded off. It yields a colorless vesicular glass, but cannot be melted into a perfect globule. Fragments of it, thrown into nitric acid, lose their transparency, and assume a nebulous appearance.

3. *Analysis.*

	By Klaproth.	By Vauquelin.	By Gmelin.		By Carpi.
	var. Elaolite.	from Monte Somma.	var. Nepheline.	var. Elaolite.	from Capo di Bove.
Alumina	30·25	49·00	33·49	34·42	9 00
Silica	46·50	46·00	43·36	44·19	40·20
Lime	0·75	2·00	0·90	0·52	20·80
Oxide of iron	1·00	1·00	1·50	1 34	1·10
Ox. manganese	0·00	0·00			12·60
Potash	18·00	0·00	7·13	4·73	12·00
Soda	0·00	0·00	13·36	16·88	0·00
Water	2·00	0·00	1·39	0·00	0·00

4. The crystallized variety occurs at Monte Somma, in the cavities of limestone rocks, ejected by Vesuvius, along with Idocrase, Garnet and Mica. It has also been found in narrow veins, traversing a kind of basalt or lava at Capo di Bove, near Rome, sometimes associated with Pyroxene. The Cavolinite and Davyne are found in the lavas of Vesuvius. The massive variety, or Elaolite, occurs near Laurig, Stavern and Frederiksvärn in Norway, imbedded in sienite, with Zircon and Sphene.

NEPHRITE. Uncleavable Petaline-Spar.

Massive: composition impalpable. Fracture coarse splintery; in some varieties slaty in the great.

Color green, particularly leek-green; rarely with a shade of blue, and still more so, with red, passing into grey and white. Translucent . . . translucent on the edges.

Very tough. Hardness = 6·0 . . . 7·0. Sp. gr. = 2·932 . . . 3·024.

1. Alone before the blowpipe, it is infusible, but becomes white.

2. *Analysis.*

	By Kastner.		By Bowen. from Smithfield, (R. I.)
Silica	50·50		44·688
Magnesia	31·00		34·631
Alumina	10·00		·562
Oxide of iron	5·50		1·747
Oxide of chrome	0 05	Lime	4·250
Water	2·75		13·417

The excess of volatile matter in the variety from Smithfield is probably owing to its intermixture with Calcareous Spar, in which it is imbedded.

3. It is brought from China and Egypt. A large block was found in the alluvial soil of the alum-earth mines at Schwemmsal in Saxony.

A very handsome sky-blue variety is found in the white primitive limestone of Smithfield, (R. I.) and a greenish and reddish-grey variety, under similar circumstances, at Easton, (Penn.)

NICKEL GLANCE. Euotomous Eruthleucone-Pyrites.

Primary form. Cube.

Secondary form. Cube, with angles truncated.

Cleavage, highly perfect, parallel with the primary form.

Lustre metallic. Color silver-white . . . steel-grey.

Hardness = 5·5. Sp. gr. = 6·097 . . . 6·129.

Compound Varieties. Massive: composition lamellar and granular.

1. Alone, in a mattrass, it decrepitates strongly, affording, at a red heat, sulphuret of arsenic, then sublimes as a transparent, yellowish-

brown mass, which, on cooling, remains clear. It is, according to BERZELIUS, an arsenical sulphuret of Nickel.

2. *Analysis.*

	By BERZELIUS.		By PFAFF.
Sulphur	19·24	14·40	12·36
Arsenic	45·34	53·32	45·90
Nickel	29·94	27·00	24·42
Cobalt	0·92	0·00	0·00
Iron	4·11	5·29	10·46
Silica	0·90	0·00	0·00

3. The variety examined by BERZELIUS was massive, and came from the cobalt mines of Loos in Helsingland, Sweden: that above described as crystallized, is found among the old ores from the mine Albertine, near Harzgerode in the Hartz. It is accompanied by Spathic Iron, Calcareous Spar, Fluor, Quartz, Galena, and Copper Pyrites.

NICKEL-GREEN. Habroneme Malachite-Haloide.

In capillary crystals, and massive; composition impalpable, pulverulent. Fracture, fine splintery to uneven, commonly earthy.

Color, apple-green, siskin-green, to greyish white. Streak, greenish white.

Soft.

1. Heated in a matrass, it yields moisture, and becomes of a darker shade of color. Upon charcoal, before the blowpipe, it smells of arsenic; and when submitted to the inner flame, it yields a metallic globule, which contains this metal.

2. *Analysis.*

By BERTHIER.

	from Allemont.
Arsenic acid	37·29
Oxide of nickel	36·49
Water	26·22
Oxide of cobalt	0·00

3. It occurs with Copper-Nickel at Allemont in Dauphiny, and probably in Saxony, Cornwall, and elsewhere, with the same mineral.

NICKELIFEROUS GREY ANTIMONY. (See *Nickel-Stibine.*)

NICKELINE. (See *Copper-Nickel.*)

NICKEL-OCHRE. (See *Nickel-Green.*)

NICKEL-STIBINE. Antimonial Eruthleucone-Pyrites.

Primary form. Cube.

Cleavage, parallel with the cube, perfect.

Massive: composition granular.

Lustre metallic. Color steel-grey, inclining to silver white.

Brittle. Hardness = 5·0 . . . 5·5. Sp. gr. = 6·451, a cleavable variety.

1. Before the blowpipe, it is partly volatilized, during which, the supporting charcoal is covered with a white coating; at last, it melts into a metallic globule, which communicates a blue color to glass of borax.

2. *Analysis.*

	By STROMEYER.	By KLAPROTH.
Nickel	36·60	25·25
Antimony	43 80	47·75
Arsenic	0 00	11·75
Sulphur	17·71	15·25
Iron and manganese	1·89	0 00

3. It is found in several mines in the principality of Nassau, along with Spathic Iron, Yellow Copper-Pyrites and Galena.

NIGRINE. (See *Rutile.*)

NITRATE OF LIME. (See *Nitrocalcite.*)

NITRATE OF MAGNESIA. (See *Nitro-Magnesite.*)

NITRATE OF POTASH. (See *Nitre.*)

NITRATE OF SODA. (See *Soda-Nitre.*)

NITRE. Prismatic Nitre-Salt. MOHS.

In capillary crystals and crusts.*

Lustre vitreous. Color white. Streak white.

Transparent . . . semi-transparent.

Sectile. Hardness = 2·0. Sp. gr. = 1·936.

Taste saline and cool.

1. It dissolves very easily in water, is not altered on being exposed to the air, and detonates with combustible substances.

2. *Analysis.*

By KLAPROTH.

Nitrate of potash	42·55
Sulphate of lime	25·45
Muriate of lime	0·20
Carbonate of lime	30·40

3. Nitre generally occurs in thin crusts on the surface of the earth, sometimes upon limestone, chalk, or calcareous tufa; also in limestone caves, and in sandstone.

4. Spain, Italy and Hungary, afford considerable quantities of this salt: in a higher state of purity, also, it is found in India. But especially in the United States, has it been found in large quantity, in limestone caves in the south western states. In Madison county, Kentucky, there is a cave 1936 feet long and 40 wide, which contains Nitre, intermingled with earthy matter and nitrocalcite. One bushel of the earth affords, by lixiviation with wood ashes, from three to ten pounds of Nitre. It is also met with, in the same vicinity, in loose masses, weighing several pounds, or imbedded in sandstone.

5. Its chief employment is in the production of gunpowder.

NITROCALCITE. Calcareous Earthy-Salt.

In efflorescent masses and silken tufts.

Color white or grey.

* The artificial crystals are right rhombic prisms of 120°, which commonly have the acute lateral edges and acute solid angles truncated. Twin crystals are also common, the face of composition being parallel with M.

1. It is very deliquescent, and soluble in water. On burning coals, it melts slowly, with slight detonation, and dries; the residue does not afterwards attract moisture from the air. It consists of lime 32·, nitric acid 57·44, water 10·56.

2. It is found in silky efflorescences, in caverns of limestone in Kentucky.

3. It is employed in the manufacture of saltpetre.

NITROGEN. Pure Nitrogen-Gas.

Gaseous. Transparent.

Sp. gr. =0·9722.

1. Nitrogen-gas extinguishes flame and animal life, and is destitute of taste and smell. It is absorbable by about 100 volumes of water.

2. It is developed, in a state of purity, or nearly so, from the surface of the ground, over an extent of four or five acres, in Hoosick, Rensselaer county, (N. Y.) becoming manifest wherever there is water. Also, at New Lebanon Springs, in the immediate vicinity, but in smaller quantities. It is evolved, in like manner, by many well known mineral springs of other countries, as those of Cheltenham and Harrowgate.

3. The origin of Nitrogen-gas has been attributed to the decomposition of atmospheric air, contained in cavernous rocks; its nitrogen and oxygen uniting to form nitric acid, which would leave an excess of nitrogen, equal at least to ten times the quantity required for the complete saturation of the oxygen in the compound nitric acid.

NITRO-MAGNESITE. Magnesian Earthy-Salt.

In deliquescent efflorescences.

Color white.

1. It is very deliquescent; and consists, when pure, of

Nitric acid - - - - - - -	72
Magnesia - - - - - - -	28.

2. It is found in limestone caves, accompanying the Nitrocalcite.

3. It is said to be employed in the manufacture of saltpetre.

NONTRONITE.

Massive: in round shaped masses, composition impalpable.

Color straw-yellow. Opake.

Okenite.

Unctuous and tender. Scratched by the nail. Exhales no argillaceous odor when breathed upon.

1. It increases one tenth in weight from soaking in water. After calcination, it is magnetic.

2. *Analysis.*

By Berthier.

Silica	44·0
Peroxide of iron	29·0
Alumina	3·6
Magnesia	2·1
Water	18·7

3. It is found in the ore of manganese, worked at the village of Pardoux, in the department of Dordogne in France. It occurs in onion-shaped masses of the size of the fist.

Nosian. (See *Sodalite.*)

Nuttallite. (See *Scapolite.*)

Obsidian. (See *Pitchstone.*)

Octahedrite. (See *Anatase.*)

Okenite.

In delicately fibrous masses.

Lustre glimmering, approaching to pearly. Color white, with a shade of yellow or blue. Translucent on the edges.

Hardness, between Fluor and Feldspar. Sp. gr. = 2·28.

1. Before the blowpipe, it melts easily into a porcelainous mass. Pieces thrown into muriatic acid, become, after some time, translucent and gelatinous at the surface, which change, gradually extends through the masses. The powdered mineral is easily decomposed by this acid, the silica appearing throughout the solution in the form of flocculi.

2. *Analysis.*

By Kobell.

Silica	56·99	55·64
Lime	26·35	26·59
Water	16·65	17·00
Alumina, oxide of iron, and traces of potash,		0·53

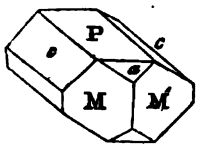
3. It is found, along with Zeolitic minerals, in amygdaloid in Greenland.

OLIVENITE. Prismatic Copper-Baryte.

Primary form. Right rhombic prism. M on M = 110° 50′.

Secondary form.

Fig. 328.



M on *a*	- - -	132° 7′
c on *c*, over P	- - -	92 30

Cleavage, traces parallel to M and *c*, the former being a little more distinct. Fracture conchoidal, uneven. Surface, M concave, *c* convex.

Lustre adamantine, indistinct. Color, various shades of olive-green, passing into leek-green, pistachio-green, and blackish green; into liver-brown and wood-brown, or also into siskin-green. Streak olive-green . . . brown. Semi-transparent . . . opake.

Brittle. Hardness = 3·0. Sp. gr. = 4·2809.

Compound Varieties. Globular and reniform shapes; surface rough, sometimes drusy; composition columnar, generally very perfect, straight and divergent, rarely promiscuous. If the composition be very thin, the lustre becomes pearly. Massive: composition columnar. Sometimes repeated composition; granular and columnar; curved lamellar and columnar. The faces of the first composition rough, of the second composition, smooth.

1. Heated alone before the blowpipe, it remains unchanged. Upon charcoal, it melts with a kind of deflagration, and is reduced. A white

metallic globule is formed, which, in the process of cooling, becomes covered with a red coating of sub-oxide of copper. In some varieties, a scoria is formed round the metallic globule. It is soluble in nitric acid.

2. *Analysis.*

	By Klaproth.	By Chenevix. var. Wood-Copper.	By Koehell.
Oxide of copper	50·62	50·00	56·43
Arsenic acid	45·00	29·00	36·71
Phosphoric acid	0·00	0·00	3·36
Water	3·50	21·00	3·50

3. It is found in veins, chiefly consisting of various ores of copper, and of Quartz.

4. It occurs in the copper-mines near Redruth in Cornwall, and in the Tynehead mine near Alston-moor in Cumberland.

Olivine. (See *Peridot.*)

Omphazite. (See *Pyroxene.*)

OPAL. Uncleavable Quartz. Mohs.

Regular forms, and cleavage, unknown.

Fracture conchoidal, of various degrees of perfection, sometimes highly perfect.

Lustre vitreous, in some varieties inclining to resinous. Color white, yellow, red, brown, green, grey; none of them lively, except some red and green ones, and generally pale; dark colors, owing to foreign admixtures. Streak white. Transparent... translucent, sometimes only on the edges, or even opake, if the colors be dark. Lively play of light observable in some varieties; others exhibit different colors by reflected and refracted light.*

* The play of light appears to depend upon openings in the interior of the mass of Opal, which are not fissures, but of an uniform shape, and reflecting the tints of Newton's scale. In some varieties of Hydrophane they are so large, that these colors cannot be any longer reflected by the included air; but they appear when filled with water, and of still higher tints, if filled with fluids possessing a high refractive power.

Opal.

Hardness =5·5 . . . 6·5. Sp. gr. =2·091, a milk-white variety; =2·060, a brownish red variety.

Compound Varieties. Small reniform, botryoidal, and stalactitic shapes, and large tuberose concretions: surface of the former smooth, of the latter rough, composition impalpable, fracture conchoidal. Massive, composition impalpable; fracture conchoidal, even. Pseudomorphoses of Calcareous Spar.

1. The present species has been greatly subdivided into varieties, and even treated of under several different species. *Hyalite* (amiatite) included the small reniform, botryoidal, and sometimes stalactitic shapes, white, and generally transparent; *Menilite*, the large tuberose forms, of a brownish grey color, and opake; *Precious Opal*, the varieties which exhibit the play of colors; *Wood-Opal*, those which appear in the shape of trunks, branches, and roots of trees; *Common Opal*, and *Semi-Opal*, consist of those varieties which have a conchoidal fracture, with medium degrees of transparency and lustre; *Hydrophane*, of an opake, dull variety, which becomes translucent on being immersed in water or some transparent fluid. *Siliceous Sinter* is a deposit from hot springs, &c., and according to its specific gravity belongs to the present species.

2. Before the blow-pipe, water is disengaged, the mineral decrepitates and becomes opake, showing the properties of pure silica. Two pieces rubbed together, give a phosphorescent light, like Quartz.

3. *Analysis.*

	By Bucholz.	By Klaproth.	
	var. Hyalite.	var. Precious Opal.	var. Menilite.
Silica	92·00	90·00	85·50
Water	6·33	10·00	11·00

The Menilite, like several other varieties, contains a small proportion of oxide of iron, alumina, lime and carbon. One variety, called *Opal-Jasper*, contains 47 p. c. of oxide of iron. The contents of water are considered foreign to the mixture of the mineral, and are supposed to change with the hygrometric state of the atmosphere.

4. Opal forms short, irregular veins, generally in porphyry. It often accompanies Calcedony in the vesicular cavities of amygdaloidal rocks; and even in agate balls. Menilite is found in adhesive clay-slate. Some

varieties are met with in metalliferous veins, along with Galena and Blende. It also occurs in petrifactions in sandstone.

5. Opal is found more plentifully in Hungary than in any other European country. The only deposit of Precious Opal in that country, is at Czerwenitza near Caschau, along with common and semi-opal, in a kind of porphyry. Traces of it have been met with at Hubertsburg. Fine varieties have lately been discovered in the Faroe islands; and most beautiful ones, sometimes quite transparent, near Gracias a Dios in the province of Honduras, America. Common Opal occurs in great quantities, at Telkobanya near Eperies, and in other parts of Hungary; in the Faroe islands, in Saxony, &c. An apple green variety is found at Kesemütz in Silesia, with Chrysoprase; and the red and yellow, bright colored varieties of Fire Opal, near Zimapan in Mexico. Semi-Opal occurs in several of the countries mentioned above; also near Frankfort, on the Maine, in Austria, Moravia, Poland, Siberia, &c. In Saxony, Bohemia and Cornwall, it is met with in metalliferous veins. Hyalite is found in amygdaloidal rocks, near Frankfort, in irregular veins; near Schemnitz in Hungary, in porphyry; also in Bohemia and various other countries. Menilite occurs at Menil Montant near Paris. Opal-Jasper is formed, wherever Opal happens to be mixed with oxide of iron, as at Telkobanya in Hungary, near Almas, and Tökörö in Transylvania. Wood-Opal is frequently found at Kremnitz and Telkobanya in Hungary, and in many districts of Transylvania, sometimes in very large trees. The only variety hitherto found in the United States, is the Hyalite, which occurs in Burke and Scriven cos., (Georgia,) lining cavities in a siliceous-shell rock. The siliceous-sinter variety occurs in small quantity at the Suanna spring in Florida.

6. Precious Opal, when possessing vivid colors, is highly prized as a gem; and is generally cut with a convex surface.

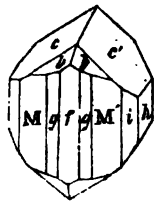
ORPIMENT. Yellow Melacone Blende. Mohs.

Primary form. Right rhombic prism. M on M = 100°.

Orpiment.

Secondary form.

Fig. 329.



M on *c*	120°	00?	PHILLIPS.	M′ on *i*	162°	38′
M on *f*	140	00		*c* on *c*′	83	30
M on *g*	177	54		*c* on *b*	145	50

Cleavage, parallel with M not very perfect, or only in traces, but parallel with *f* highly perfect. The faces of cleavage are streaked parallel to the edges of intersection with M. Fracture scarcely observable. Surface, *f* rough, but even; all the other faces are streaked parallel to their edges of combination with M, and generally uneven.

Lustre pearly metallic upon the perfect faces of cleavage, the rest resinous. Color, several shades of lemon-yellow. Streak lemon-yellow, generally, a little paler than the color. Semi-transparent . . . translucent on the edges.

Sectile. Thin laminæ are highly flexible. Hardness $=1{\cdot}5 \ldots 2{\cdot}0$. Sp. gr. $=3{\cdot}480$, a cleavable variety.

Compound Varieties. Reniform, botryoidal, and other imitative shapes: composition curved lamellar, faces of composition commonly rough. Massive: composition granular, of various sizes of individuals; faces of composition uneven, often irregularly streaked.

1. Before the blow-pipe, upon charcoal, it burns with a blue flame, and emits fumes of sulpur and arsenic. It is soluble in the nitric, muriatic and sulphuric acids.

Orpiment.

2. *Analysis.*

	By KLAPROTH.	By LAUGIER.
Sulphur	38·00	38·14
Arsenic	62·00	61·86

3. Orpiment is found in imbedded nodules, and rarely in imbedded crystals, in blue clay, accompanied by sulphur.

4. It occurs at Tajowa near Neusohl in Lower Hungary, in the neighborhood of Vienna, and in Wallachia and Servia. At Kapnik in Transylvania, and Felsöbanya in Upper Hungary, it occurs in metalliferous veins, with Galena, Blende, Native Arsenic and Realgar. It is found likewise in Natolia, China and Mexico.

5. It is used as a pigment.

ORTHITE. (See *Allanite.*)

OSMELITE.

Massive: composition columnar, individuals thin and scopiformly or stellularly arranged, and these aggregations collected again into coarse granular concretions.

Cleavage only in one direction.

Lustre resinous or oily. Color greyish white, but after being exposed to the weather, dark hair-brown. Translucent.

Hardness intermediate between 4·0 and 5·0. Sp. gr. = 2 79... 2·83.

1. It emits at common temperatures an argillaceous odor, which is increased by breathing upon it. In the mouth it tastes like clay, but undergoes no separation of parts.

2. It occurs in Calcareous Spar mixed with Datholite in veins in Trachyte, at Niederkerchen, near Wolfstein on the Rhine.

OSTRANITE.

Primary form. Right rhombic prism. M on M = 96°.

Secondary forms. The primary form, having the acute lateral edges slightly modified, and the angles of the base deeply truncated.

Cleavage, parallel to the smaller diagonal of the base, scarcely perceptible.

Lustre vitreous. Color clove-brown.

Hardness = 7·0 ... 8·0. Sp. gr. = 4·3 ... 4·4.

Oxahevrite.

1. Alone, before the blow-pipe, it does not melt, but becomes paler. With borax, it melts with difficulty into a transparent glass.

2. It is found in Norway.

Ouvarovite.

Primary form. Rhombic dodecahedron.

Lustre vitreous. Color emerald-green. Transparent.

Harder than Garnet.

1. It does not fuse when heated before the blow-pipe, nor lose its color or transparency.

2. It is found imbedded in Chrome-Ore, in the environs of Bissersk in Siberia.

Oxahevrite.

Primary form. Octahedron with a square base.

Secondary form. The primary, having the angles at the base truncated, so as to form when enlarged the faces of a square prism.

Cleavage perpendicular to the axis, but with much difficulty. Surface even, but not brilliant.

Color, light-grey, leek-green, olive-green, and reddish-brown.

Hardness, rather below Apatite. Sp. gr. = 2·21.

Compound Varieties. Massive: in thin seams and veins.

1. *Analysis.*

By Turner.

Silica	50 76
Lime	22·39
Potash	4·18
Peroxide of iron	3·39
Alumina	1·00
Fluoric acid	a trace.
Water	17·00

2. It occurs in ligneous petrifactions, where the wood has been replaced by Calcareous Spar, of a fine ochre yellow color, and more or less crystallized. From Oxhaver in the north east of Iceland.

Oxide of Arsenic. (See *White Arsenic.*)

Ozokerite.

Massive. Composition impalpable.

Color, between green and brown.

Hardness, may be kneaded between the fingers like dough. Sp. gr. = 0·955 . . . 0·970.

1. It melts in the flame of a candle, into a clear mass. It is neither soluble in alcohol nor water, even when boiling, and but slowly so, in ether and spirits of turpentine. It burns like wax with a soft clear flame, and on being extinguished, diffuses an agreeable odor.

2. It occurs at Slauik in Moldavia.

OXYGEN. Pure Oxygen-Gas.

Gaseous. Transparent.

Sp. gr. = 1·1111.

1. Oxygen-gas is a powerful supporter of combustion. A freshly extinguished taper introduced into a small vial of it, is immediately rekindled with a slight explosion; and iron-wire, on being previously heated, burns in it, with brilliant scintillations. It is wholly free from odor and taste.

2. The evolution of oxygen from vegetables, its only natural source, depends upon the influence of vitality. The carbonic acid they absorb is decomposed, the carbon appropriated by the plant, while this species is set at liberty. Its emission from vegetables may be detected by exposing a healthy mint of some kind, in a bell-glass of water over a pneumatic cistern to the sun of a summer's day: the oxygen-gas will collect in the upper part of the receiver, and may be transferred to a convenient vessel, and tested in the usual manner.

PARANTHINE. (See *Scapolite.*)

PARGASITE. (See *Hornblende.*)

PAULITE. (See *Hypersthene.*)

PEARL-GLIMMER. (See *Margarite.*)

PEARLSPAR. (See *Dolomite.*)

PEARLSTONE. (See *Pitchstone.*)

PECTOLITE.

In spheroidal masses: composition columnar, diverging. Lustre vitreous to pearly. Color white, yellowish or greyish. Hardness, between Fluor and Feldspar. Sp. gr. = 2·69.

1. Before the blow-pipe, it yields a white, transparent glass. After having been calcined, it forms a jelly in muriatic acid.

Oxygen.

2. *Analysis.*
By KOBELL.

Silica	51·80
Lime	33·77
Soda	8·26
Potash	1·57
Water	8·89
Alumina and oxide of iron	0·90

3. It occurs on Natrolite, a variety of Mesotype, at Monte Baldo in South Tyrol.

PEGAMITE.

Primary form. Right rhombic prism. M on M = 127 . . . 128°.

Secondary form. Primary form, having the acute lateral edges, and the acute terminal angles, truncated.

Cleavage, parallel with P, but difficult; also parallel with the shorter diagonal of the prism. Fracture conchoidal.

Lustre vitreous. Color green, pistachio, leek, apple or grass: also, pale mountain green, greenish grey, and greenish white. Streak white. Transparent or translucent.

Brittle. Hardness (scale of BREITHAUPT) = 5·25 . . . 5·50. Sp. gr. = 2·492 . . . 2 496.

1. Before the blowpipe, in the tube, it gives much water. On charcoal, it loses its color, imparting, at the same time, a beautiful green color to the flame of the lamp. It is infusible. It contains 22½ . . . 24 per cent. of water.

2. It has been found on a hill between the lakes Strieges and Frankenberg, where it occurs in a transition flinty slate.

3. It is probably a variety of Wavellite.

PEGMATOLITE. (See *Feldspar.*)

PELIOM. (See *Iolite.*)

PELOKONITE.

Massive; composition impalpable. Fracture conchoidal.

Lustre vitreous, feeble. Color bluish black. Streak liver-brown. Opake.

Hardness = 3·0. Sp. gr. = 2·50 . . . 2·56.

1. It is very soluble in muriatic acid, the solution having a pistachio-green color.

Peridot.

2. It is found in the Terra Amarilla and the Remolinos in Chili, along with Green Malachite, and an unknown, blackish brown mineral with a yellow streak.

Peponite.

Massive: composition lamellar, rarely columnar, impalpable. Cleavage, apparently parallel to the sides of a rhombic prism. Lustre pearly. Color lake, and mountain-green. Streak greenish white. Translucent, only on the edges.

Hardness = 2·0. Sp. gr. = 2·969.

Emits an argillaceous odor when moistened.

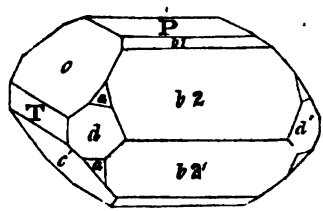
1. Locality not mentioned.

PERIDOT. Prismatic Chrysolite. Mohs.

Primary form. Right rectangular prism.

Secondary form.

Fig. 330.



P on T or *d*	-	-	90°	00′	Phillips.
P on *e*	-	-	140	00	"
P on *b*1	-	-	132	52	"
P on *b*2	-	-	115	00	"
T on *d*	-	-	130	00	"
e on *e*′	-	-	80	00	"
*b*2 on *b*2′	-	-	130	00	"
d on *d*′	-	-	100	00	"
d on *a*	-	-	160	00	"

Peridot.

Irregular forms, grains.

Cleavage, parallel with P easily obtained, sometimes traces of T. Fracture conchoidal. Surface, the faces of the prism streaked horizontally, those of the rest of the faces, smooth and even. The grains possess an uneven surface.

Lustre vitreous. Color various shades of green, as pistachio-green, olive-green, nearly asparagus-green and grass-green, sometimes passing into brown. Streak white. Transparent . . . translucent.

Hardness =6·5 . . . 7·0. Sp. gr.=3·441, a crystallized variety.

Compound Varieties. Irregular spheroidal masses, imbedded in rocks: composition granular, individuals easily separated, faces of composition uneven and rough.

1. Before the blow-pipe, it assumes a darker color, but does not melt or lose its transparency. It loses its color in nitric acid. Varieties of the present species may be produced artificially, by mingling the constituents in the requisite proportions, and exposing them to a high temperature.

2. *Analysis.*

	By Klaproth var. Chrysolite.	By Klaproth. var. Chrysolite. fr. meteoric iron.	By Shepard. var. Chrysolite. fr. meteoric stone.	By Klaproth. var. Olivine.
Silica	39·00	41·00	42·30	50·00
Magnesia	43·50	48·50	31·46	38·50
Ox. of iron	19·00	18·50	20·67	12·00
Lime	0·00	9·00	0·00	0·25
Soda, Ox. chrome, & Sulphur	0·00	0·00	5·57	0·00

3. The original repository of the implanted crystals of Peridot is not known: they are said to come from Upper Egypt, and are frequently brought to Europe by way of Constantinople. Less distinct crystals and imbedded grains are found in lava, in various kinds of basalt, &c., as in the neighborhood of Vesuvius, in Saxony, Bohemia, Silesia, Hungary,

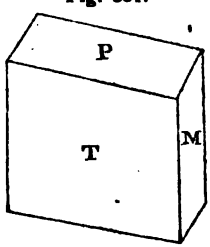
&c. It occurs in large spheroidal masses, which are not pebbles, mixed with Bronzite in Trap tuff, at Kapfenstein in Lower Hungary, and at Habichtswald in Hessia. It is contained also in the Meteoric Iron of Siberia, as well as in many meteoric stones that have fallen at different periods.

4. The transparent varieties are sometimes used as gems.

PERIKLIN. Heterotomous Feld-Spar. Mohs.

Primary form. Doubly oblique prism.

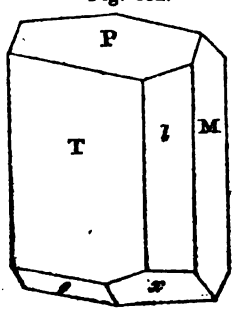
Fig. 331.



P on M	93°	19′
M on T	120	18
T on P	114	45

Secondary form.

Fig. 332.



M on *l*	120°	37′

Periklin.

Cleavage, parallel to P and T perfect, to M only in traces.

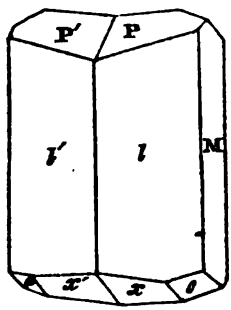
Fracture uneven.

Lustre pearly, sometimes vitreous upon P and T. Color white, yellowish and reddish. Streak white. Semi-transparent, to translucent on the edges.

Brittle. Hardness =6·00. Sp. gr.=2·54...2·55.

Compound Varieties. Twin-crystals; axis of revolution perpendicular to the prismatic axis.

Fig. 333.



Massive: composition granular.

1. Before the blow-pipe, it melts with difficulty into a semi-transparent glass.

2. *Analysis.*

By Gmelin.

Silica	67·94
Alumina	18·93
Soda	9·99
Potash	2·41
Lime	0·15
Protoxide of iron	0·48

3. It is found at Zöblitz in Saxony, entering into the composition of a sienite; also in crystals with Rutile in the Tyrol, on St. Gothard, and in the Saualpe of Carinthia.

PERITOMOUS LEAD-BARYTE. (See *Kerasite.*)

PETALITE. Prismatic Petaline-Spar. MOHS.

Primary form. Doubly oblique prism?

Cleavage, a prism of 95° nearly, and parallel with its longer diagonal; the latter more distinct. Fracture imperfectly conchoidal.

Lustre vitreous, inclining to resinous; pearly upon faces of cleavage. Color white, with tinges of blue, pink and green. Streak white. Translucent.

Brittle. Hardness = 6·0 . . . 6·5. Sp. gr. = 2·439.

Compound Varieties. Massive; composition columnar, of various sizes of individuals, sometimes impalpable, and generally strongly coherent. If the composition be impalpable, the fracture is splintery. Extremely tough.

1. If exposed to the highest heat of the blow-pipe on charcoal, it becomes glassy, semi-transparent and white, but melts only upon the edges. If gently heated, it emits a blue, phosphorescent light.

2. *Analysis.*

	By ARFWEDSON.	By GMELIN.
Silica	79·212	74·17
Alumina	17·225	17 41
Lithia	5·761	5·16
Lime	0·000	0·32

3. Petalite occurs in the Swedish island of Utön, where it occurs in boulders of limestone, accompanied by Quartz, Feldspar and Tourmaline. In the United States, its only locality is Bolton, (Mass.) where it exists in a lime-quarry, along with Scapolite, Sphene and Pyroxene.

PETROLEUM. (See *Bitumen.*)

PETROSILEX.

Massive: composition impalpable. Fracture fine grained.

Lustre waxy. Colors various, grey, green, brown and red. Translucent.

Hardness = 7·0.

Pharmacolite.

1. Before the blow-pipe, it fuses with greater difficulty than Feldspar.

2. *Analysis.*

By BERTHIER.

	A red variety, from Sahlberg in Sweden.	A blackish green variety, from Aran.
Silica	79·5	67·60
Alumina	12·2	8·70
Lime	0·0	3·50
Soda	6·0	5·70
Potash	0·0	5·50
Magnesia	1·1	1·50
Oxide of iron	0·5	3·60

3. Petrosilex is probably a variety of Feldspar, or Albite.

PHARMACOLITE. Hemi-prismatic Gypsum-Mica.

Primary form. Right oblique angled prism.

Secondary forms.

Fig. 334.

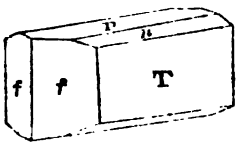
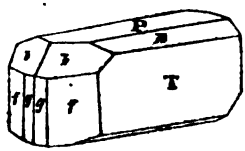


Fig. 335.



f on *f*	-	-	117° 24′	HAIDINGER.
n on *n*	-	-	141 8	"

The crystals are lengthened in the direction of T, (edges of combination between T, *n* and P,) and attached at one of the extremities, in most cases several together, so as to form stellated or divergent groups. On the disengaged terminations of the crystals, one of the faces *f* is enlarged, so as generally to make the other disappear.

Pharmacolite.

Cleavage, parallel to P highly perfect, and easily obtained. Fracture uneven. Surface, faces P and *n* are deeply streaked parallel to their common edges of combination.

Lustre vitreous. P slightly inclining to pearly, both upon faces of cleavage and of crystallization. Color white, inclining to yellowish. Streak white. Transparent, or translucent.

Sectile. Thin laminæ are flexible in a direction perpendicular to the edges between T, *n* and P.

Hardness =2·0...2·5, nearer the latter. The perfect faces of cleavage are below 2·0. Sp. gr. =2·730.

Compound Varieties. Globular aggregations of acicular crystals. Reniform, botryoidal and stalactitic shapes. Composition thin columnar...impalpable. Farinaceous.

1. The crystals above described, were first observed upon a specimen whose locality is unknown, associated with the Haidingerite, but have since been discovered at Wittichen.

2. Before the blow-pipe, it emits an arsenical odor, and melts with difficulty into a white enamel. It is dissolved in nitric acid without effervescence.

3. *Analysis.*

	By Klaproth. fr. Wittichen.	By John. fr. Andreasberg.	By Turner.
Lime	25·00	27·28	76·92
Arsenic	50·54	45·68	
Water	24·46	28·86	27·08

4. It is found in the principality of Fürstenberg, at Andreasberg in the Hartz, at Riechelsdorf in Hessia, and other places, in veins that also contain Native Arsenic and Smaltine.

5. The description of the *Picropharmacolite* does not differ from that given above of the Pharmacolite. The only difference consists in a small quantity of magnesia, 3·218 p. c., which the former contains. It comes from the cobalt mines of Riechelsdorf in Hessia.

Pharmacosiderite. (See *Cube-Ore.*)

PHASTINE.

Massive: composition lamellar, impalpable. Cleavage, parallel with the sides of a rhombic prism, in traces; also, with its two diagonals most distinct, parallel with the shorter.

Lustre pearly. Color grey. Streak white.

Hardness = 1·25 ... 1·50. Sp. gr. = 2·825.

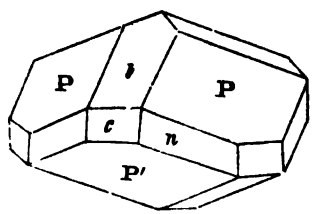
1. Locality not mentioned.

PHENAKITE. Phenakine Emerald.

Primary form. Rhomboid. P on P = 115° 25′.

Secondary form.

Fig. 336.



P on *b*	-	-	-	147°	42′	30″
P on *n*	-	-	-	122	17	30

Cleavage, parallel to *n*.

Lustre vitreous. Color bright wine yellow, inclining to red; also inclining to white. Transparent ... opake.

Hardness, above Quartz. Sp. gr. = 2·969.

1. *Analysis.*

By HARTWALL.

Silica	55·14
Glucina	44·47
Alumina and magnesia	0·39

2. It is found in Perm, 85 wersts from Catharinenburg.

PICROLITE. Fibrous Atelene Picrosmine.

Massive: composition thin columnar, consisting of straight and delicate individuals. Fracture uneven, rarely splintery.

Lustre vitreous: in very thin individuals, satiny. Color some shade of green or greenish-white, greenish-grey, mountain green, oil-green, leek-green, and blackish-green. Translucent on the edges.

Brittle, except in the finest fibres, when it is flexible. Hardness =3·0...4·0. Sp. gr. =2·591.

1. When heated before the blow-pipe in thin fragments, it coils up at the extremity, and fuses into an opake, white mass. With phosphoric salt, it melts into a transparent glass, with the exception of a skeleton of silica.

2. *Analysis.*

By Almroth.

Silica	40·04
Magnesia	38·80
Water	9·08
Protoxide of iron	8·28
Carbonic acid	4·70

3. This species, as first described by Hausmann, (with no other properties than its columnar composition, a faint pearly lustre, a leek green, to yellow color, streak a little shining, and hardness from 3·0... 6·0,) was quoted as forming irregular veins in the beds of Magnetic Iron of Taberg and Nordmayken in Sweden, and as occurring at Reichenstein in Silesia. As described above, it has several localities in the United States. In particular, it occurs in large masses, which exist in irregular seams in the verd antique marble of West Haven and Milford, (Conn.); at which places the individuals are coarse, and sometimes a little curved. At Weathersfield in Vermont, it forms numerous narrow veins through a serpentine rock, which also contains Dolomite, the individuals being very thin, and exhibiting a satiny lustre. At Kelly Vale, in Vermont, also, it is found in somewhat wider veins, coarsely columnar, of a light oil-green color, and containing much yellow.*

* The foregoing American varieties afforded the description above given, respecting color, composition, specific gravity, hardness, and behavior before the blow-pipe. These also lost 13·04 p. c. wt., on calcination.

Picrosmine.

The thin seams of Asbestus, so called, in the Serpentine of Newburyport, (Mass.) Newport, (R. I.) and numerous other places in New England, probably belong to this species.

PICNITE. (See *Topaz.*)

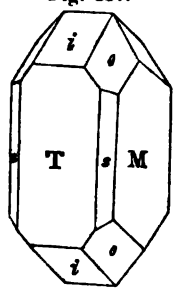
PICROPHARMACOLITE. (See *Pharmacolite.*)

PICROSMINE. Prismatoidal Atelene Picrosmine.

Primary form. Right rectangular prism: from cleavage.

Cleavage, affords the form in the annexed figure.

Fig. 337.



i on *i*	- - - -	117° 49′
s on *s*	- - - -	126 52

Parallel to M, the cleavage is perfect; parallel to T less so, and least of all, to *i*.

Fracture uneven, scarcely perceptible.

Lustre pearly, distinct upon M, inclining to vitreous upon the others. Color greenish-white, passing into greenish-grey and mountain-green, sometimes also oil-green, leek-green, and blackish green. Streak white, dull. Translucent on the edges.

Picrosmine.

Very sectile. Hardness = 2·5 . . . 3·0. Sp. gr. = 2·66, of a cleavable compound variety. 2·596, of a columnar variety.

Compound Varieties. Massive: composition granular, strongly coherent. If the composition becomes impalpable, the fracture is earthy. The particles of columnar composition are very thin; fracture splintery.

1. Before the blow-pipe, it is infusible, but gives out water, becoming first black, then white and opake, and acquires a degree of hardness nearly = 5·0. It is soluble in phosphoric salt, with the exception of a silica-skeleton. When treated with a solution of cobalt, it assumes a pale red color. It appears therefore, to contain water, silica and magnesia.

2. The cleavable varieties have been found, accompanied by Magnetic Iron, and Dolomite, in a bed in primitive rocks. The only locality hitherto known, is the iron mine called Engelsburg, near Presnitz in Bohemia.

3. It is likely that several varieties of Asbestus fall within the present species.

Pictite. (See *Turnerite.*)

Pimelite.

Nickel-Ochre, mixed with clay.

Pinguite.

Massive: impalpable: resembles Green Iron-Ore.

Fracture large conchoidal.

Lustre resinous. Color, siskin-green and oil-green. Streak paler. Translucent on the edges.

Hardness = 1. Sp. gr. = 2·31.

Emits an earthy odor, when moistened.

1. *Analysis.*
By Karsten.

Silica	36·90
Peroxide of iron	29·50
Protoxide of iron	6·10
Alumina	1·80
Magnesia	0·45
Oxide of manganese	0·14
Water	25·10

2. It occurs in a vein of Heavy Spar, in the mine of Neu Beschert Glück, in the mine of Saxon Erzgebirge, and at Geilsdorf in Plauen.

PINITE. (See *Mica.*)

PISSOPHANE.

Stalactitic, massive, and impalpable. Fracture conchoidal.

Lustre vitreous. Color pistachio-green, asparagus-green, and olive-green, passing into brown. Streak white; in the brown variety, a pale yellow. Transparent to translucent.

Hardness = 1·75 ... 2·50. Sp. gr. = 1·92 ... 1·98.

It falls to pieces in water.

1. It occurs at Reichenbach, and in Garnsdorf.

PITCHBLENDE. Uncleavable Baryte-Ore.

Regular forms and cleavage, unknown. Fracture conchoidal, uneven.

Lustre imperfectly metallic. Color greyish-black, inclining sometimes to iron-black, also to greenish black and brownish black. Streak black, a little shining. Opake. Brittle. Hardness = 5·5. Sp. gr. = 6·468.

Compound Varieties. Reniform: composition columnar, impalpable; aggregated into a second curved, lamellar composition, the faces of composition being smooth and shining. Massive: composition granular, individuals not distinguishable.

1. Alone, before the blow-pipe, it is infusible, but it melts with borax into a greyish scoria. If reduced to powder, it is slowly soluble in nitric acid.

2. *Analysis.*

	By KLAPROTH.	By PFAFF.
Protoxide of uranium	86·50	84·52
Protoxide of iron	2·50	8·24
Silica	5·00	2·02
Sulphuret of lead	6·00	4·29
Oxide of cobalt	0·00	1·42

3. It chiefly occurs in silver veins, and is accompanied by various ores of silver and lead, and often intimately mixed with Yellow Copper Pyrites and Galena.

4. Its chief localities are Johanngeorgenstadt, Marienberg, Annaberg, and Schneeberg in Saxony; and Joachimsthal and Fribus in Bohemia. In Cornwall, it has been found in the tin mines of Tincroft and Tolcarn, near Redruth.

5. It is used in painting upon porcelain, yielding a fine orange color in the enamelling fire, and a black one, in that in which the porcelain itself is baked.

PITCHSTONE. Empyrodox Quartz. Mohs.

Regular forms unknown. Grains.

Cleavage none. Fracture conchoidal, sometimes highly perfect, sometimes less distinct. Surface, the larger grains uneven and rough, the smaller ones smooth.

Lustre vitreous and resinous. Color black, brown, red, yellow, green, grey, white; none of them bright. There occurs a distinct velvet-black. Streak white. Faintly transparent... translucent on the edges.

Hardness = 6·0 ... 7·0. Sp. gr. = 2·395, Obsidian from Iceland; =2·212, Pitchstone from Meissen.

Compound Varieties. Massive: composition granular, strongly connected, so as to be scarcely recognizable; fracture more or less perfectly conchoidal, uneven and splintery. The whole mass is often traversed with separating faces, which may be considered as rudiments of the faces of lamellar composition: often the composition is granular, thick or thin, and generally bent; the faces of composition being smooth, and possessing pearly lustre. Small grains of Obsidian are often enveloped in a number of successive thin coats; several of these are again surrounded by other coats, and so on several times, which pro-

duce a very remarkable composition. Vesicular: the cavities often elongated in one direction, parallel, and in such number, that the mass appears fibrous, and of a pearly lustre.

1. The varieties of Pitchstone have generally been treated of under four species: viz. Obsidian, Pitchstone, Pearlstone, and Pumice. *Obsidian* possesses the most perfect conchoidal fracture, and high degrees of a pure vitreous lustre. A variety of Obsidian which is transparent, is called *Marekanite*. When the high perfection of the conchoidal fracture disappears, and we meet with an uneven or splintery fracture, its lustre at the same time diminishing and passing into resinous, we are presented with the variety *Pitchstone*. Pitchstone often contains those faces of distinct concretion, which arise from composition. When these are numerous, variously curved, and containing but little matter between them, a transition into *Pearlstone* is formed; the peculiarity of which depends upon the roundish masses into which it separates, and which generally allow themselves to be resolved into thin films, not unfrequently including a grain of Obsidian. The Obsidian itself is often vesicular, the cavities being small, and keeping a constant direction. If there are a great many of them of larger sizes, the whole mass becomes apparently very light, the original color disappears, and there is pearly or silky lustre in one direction. Thus *Pumice* is generally formed.

2. Before the blow-pipe, these varieties melt with more or less facility, according to the fusibility of their ingredients, into a vesicular glass, or they yield an enamel.

3. *Analysis.*

	By Descotils.	By Berthier.	By Klaproth.		
	var. Obsidian.		var. Pitchstone.	var. Pearlstone.	var. Pumice.
Silica	72·00	69·46	73·00	72·25	77·50
Alumina	12 50	2·60	14·50	12·00	17·50
Potash	10·00	7·12	0·00	4·50	3·00
Soda		5·08	1·75	0·00	
Ox. iron and mang.	2 00	2·60	1·10	1·60	1·75
Lime	0·00	7·54	1·00	0·50	0·00
Magnesia	0·00	2·60	0·00	0·00	0·00
Water	0·00	3·00	8·50	4·50	0·00

Pitchstone.

4. Pitchstone forms mountain masses, and is generally in close connexion with porphyry. Many of the other varieties occur under similar circumstances. It is often the paste of certain kinds of porphyry, containing imbedded crystals of other minerals; and in a similar manner, Obsidian, Pearlstone, and Pumice, form, each their porphyry, denominated after the kind of paste which contains the crystals. All these varieties occur also in beds in sandstone, in which it has been observed that in some places they lie regularly between the strata, or abruptly assume another situation, interrupt the strata, and then appear in the shape of regular veins. Several of the pitchstone veins in red sandstone seem to have the same origin; but it cannot be determined whether this also is the case in similar veins in granite, where they likewise occur. Obsidian frequently occurs in grains. Pumice, and several of the other varieties of Pitchstone, are products of active volcanoes.

5. Considerable masses of very distinct Pitchstone occur on the foot of the Saxon metalliferous mountains at Meissen, also at Planitz near Zwickaw, passing into Obsidian in the isle of Arran. Pearlstone, including grains of Obsidian, is found between Tokay and Keresztur, and at Glashütte near Schemnitz in Hungary, at Cabo de Gata in Spain, near Ochotzk in Siberia, &c. Obsidian is very frequent in Iceland, where it exists in grains, angular pieces and beds; it is also found at Schemnitz and Glashütte in Hungary, of a green color at Moldauthein in Bohemia, and shewing every stage of the passage into Pumice, in the Lipari islands, also in Teneriffe, Peru, and New Spain. Pumice occurs at Vesuvius, in Ischia, the Lipari islands, and several islands of the *Grecian* Archipelago, in Teneriffe; near Tokay, Schemnitz, and other places in Hungary; near Andernach, and the lake of Laach on the Rhine; in Quito and Mexico, &c. In several of these countries, also, it is met with in conglomerates.

6. Obsidian is employed for mirrors, vases, snuff boxes, &c.; in Mexico and the island of Ascension, very sharp edged fragments are used as tools and weapons. Pumice yields a well known material for grinding and polishing, and is also employed as a filtering stone.

PITCHY IRON-ORE. (See *Iron Sinter* and *Triplite.*)

PLASMA. (See *Quartz.*)

PLEONASTE. (See *Spinel.*)

PLUMBAGO. Rhombohedral Graphite-Mica. MOHS.

Primary form. Rhomboid, of unknown dimensions.

Secondary forms. 1. Six sided prism. 2. Six sided prism, with terminal edges truncated. The crystals invariably possess a tabular-appearance.

Cleavage, perpendicular to the axis of the rhomboid, (or parallel with the bases of the hexagonal tables,) perfect. Fracture uneven, scarcely observable. Surface, bases of the prisms generally smooth, or faintly striated parallel to their edges of combination; the rest of the faces rough.

Lustre metallic. The highest degrees of lustre are found upon the perfect faces of cleavage, and upon the bases of the hexagonal tables. Color iron-black, dark steel-grey. Streak black, shining. Opake.

Sectile. Thin laminæ are highly flexible. Hardness =1·0...2·0. Sp. gr. =2·0891.

Compound Varieties. Massive: composition granular, the individuals flat and scaly, of various sizes, frequently impalpable. Of the latter, the fracture is conchoidal or even.

1. In a high degree of heat, it is combustible, and leaves a residue of oxide of iron. It is infusible.

2. *Analysis.*

	By SCHEELE.	By VAUQUELIN.	By SAUSSURE.
Carbon	81·00	92 00	96·00
Iron	10·00	8·00	4·00
Oxygen	9·00	0 00	0 00

3. The varieties of this species are found in beds, or form beds by themselves, in slaty and ancient trap-rocks. They seem often to replace Mica and Talc in certain rocks. It is particularly in beds of limestone that the crystallized variety of Plumbago occurs. It is likewise met with in the coal formation.

4. One of the most remarkable deposits of Plumbago is at Borrowdale in Cumberland, in a bed of trap, very much interrupted, and alternating with clay-slate. It occurs crystallized in Greenland, in the parish of Pargas in Finland; and different varieties are known from the Tyrol, Salzburg, Piedmont, France, Spain, and Norway.

Plumbago is of very common occurrence in the United States. Some of the handsomest crystallized varieties occur near Ticonderoga on Lake George, upon Roger's rock, where it is associated with Pyroxene and Sphene; and in the vicinity of Amity, Orange county, (N.Y.) at which place it occurs in white limestone, with Spinel, Brucite, Hornblende, &c. A compact variety is found in large masses, disseminated in veins through gneiss, at Sturbridge, (Mass.) A similar variety occurs at Grenville, (Lower Canada,) along with Sphene and Tabular Spar, in white limestone.

5. Plumbago is much employed in the manufacture of lead pencils, and of crucibles. It is also used to diminish friction, and to protect iron from oxidation.

PLUMBOCALCITE. Microtine Lime-Haloide.

Primary form. Rhomboid. P on P = 104° 53′ 30″.

Surface of the crystals rounded.

Lustre pearly. Color white. Transparent to translucent.

Hardness = 2·5 ... 3·0. Sp. gr. = 2·82.

Compound Varieties. Massive.

1. Heated in a platina crucible, or in a glass tube, it decrepitates, and after some time assumes a brownish, or pale reddish, tint. A small fragment, dissolved in muriatic or nitric acid, gives a white precepitate, with caustic ammonia, which becomes black on the addition of hydrosulphuret of ammonia.

2. *Analysis.*
By Turner.

Carbonate of lime	92·2
Carbonate of lead	7·8

3. It occurs at Wanlockhead in Scotland.

PLUMBO-GUMMITE. Staphyline Lead-Baryte.

Reniform. Surface smooth. Composition thin columnar . . . impalpable.

Cleavage, parallel with the sides of a rhombic prism, in traces. Fracture conchoidal.

Lustre resinous. Color yellowish-brown and reddish-brown, striped. Translucent.

Hardness =4·0 . . . 4·5. Sp. gr. =6·3 . . . 6·4.

If rubbed in an isolated state, it acquires a strong negative electricity.

1. If quickly heated before the blow-pipe, it decrepitates, and loses its water; but is infusible by itself. With borax, it yields a transparent, colorless glass, without reducing the lead. Its powder is decomposed by concentrated muriatic acid.

2. *Analysis.*

By Berzelius.

Oxide of lead	40·14
Alumina	37·00
Water	18·80
Sulphurous acid	0·20
Lime, oxides of iron and manganese	1·80
Silica	0·60

3. It occurs at Huelgoet, near Poullaouen in Brittany, in clay-slate, along with Galena, Blende, Iron Pyrites and Pyromorphite.

Plusin-Glance.

Massive; in drusses.

Color, between iron-black and blackish lead-grey.

Hardness (scale of Breithaupt) = 3. Sp. gr. = 6·189 . . . 6·244.

1. It is found at Freiberg.

POLYBASITE. Axotomous Polypoione-Glance.

Primary form. Regular hexagonal prism?

Secondary form. The primary, having the terminal edges replaced by three or six planes.

Surface of the crystals streaked upon the terminal planes, parallel to the sides of an equilateral triangle, or parallel to the alternating edges of the six-sided prism. Fracture uneven.

Lustre splendent. Color, iron-black.

Sectile. Hardness between Common Salt and Calcareous Spar. Sp. gr.=6·214.

Compound Varieties. Massive.

1. *Analysis.*

	By Rose.		By Brandes.
	fr. Mexico.	fr. Schemnitz.	fr. Neu-Morgenstern.
Sulphur	17·04	16·83	19·4000
Antimony	5·09	0·25	0·0000
Arsenic	3·74	6·23	3·3019
Silver	64·29	72·43	65·5000
Copper	9·93	3·04	3·7500
Iron	0·06	0·33	5·4600
Zinc	0·00	0·59	0·0000

2. It occurs partly in super-imposed crystals, partly massive and disseminated, in the mine of Guanaxuato, in Mexico; also at Guansamez in Durango, with yellow Copper Pyrites and Calcareous Spar; also with Stilbite, at Andreasberg in the Hartz, and probably near Freiberg.

POLYHALLITE. Stelene Brithyne-Salt.

Massive: composition columnar. Cleavage parallel with a prism of 115°. Fracture splintery, uneven.

Lustre resinous. Color smoke-grey and pearl grey, flesh-red and brick-red.

Hardness greater than 3·0. Sp. gr. =2·7689. Stromeyer.

Taste saline and bitter.

1. In the flame of a candle, it melts into an opake globule, and is readily dissolved in water, the solution letting fall a precipitate of sulphate of lime.

2. *Analysis.*

By BERTHIER.

	from Vic.		
	Crystallized.	Red mass. var.	Grey mass. var.
Sulphate of lime	40·0	45·0	40·0
Sulphate of soda	37·6	44·6	29·4
Sulphate of mang.	0·5	0·0	0·0
Sulphate of magnesia	0·0	0·0	17·6
Chloride of sodium	15·4	6·4	0·7
Alumina and ox. iron	4·5	3·0	4·3
Loss by calcination	2·0	1·0	8·0

By STROMEYER.

	from Ischel.
Anhydrous sulphate of lime	22·2184
Anhydrous sulphate of potash	27·6347
Anhydrous sulphate of magnesia	20·0347
Anhydrous sulphate of iron	0·2927
Hydrous sulphate of lime	28·4580
Chloride of sodium	0·1910
Chloride of magnesium	0 0100
Peroxide of iron	0·1920

3. It occurs at Berchlesgaden and Ischel, along with Common Salt, Gypsum and Anhydrite; also in the salt mines of Vic in Lorraine.

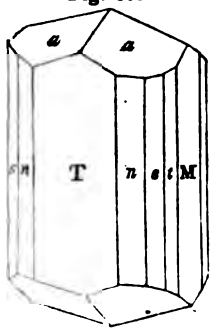
POLYMIGNITE. Melanous Eruthrone-Ore.

Primary form. Right rhombic prism.

Secondary form. Primary, having the lateral edges deeply truncated, or slightly bevelled, and terminated by four-sided pyramids, which, viewed as an octahedron with a rhombic base, have angles of 136° 30′ and 116° 30′.

Polymignite.

Fig. 338.



Cleavage, imperfect in the direction of the replacing faces of the prism. Fracture conchoidal.

Lustre metallic. Color black. Streak brown. Opake. Hardness =6·5. Sp. gr. =4·8.

1. Alone, upon charcoal, before the blow-pipe, it is unaltered. With borax, it melts into an iron-colored glass. With salt of phosphorus, it is with difficulty dissolved; the glass appearing reddish in the reduction fire, and the color not undergoing change from the addition of tin. With soda, it becomes greyish-red, but does not melt.

2. *Analysis.*

By Berzelius.

Titanic acid	46·30
Zirconia	14.14
Oxide of iron	12·20
Lime	4·20
Oxide of manganese	2·70
Oxide of cerium	5·00
Yttria	11·50

3. Its locality is Fredrichsvärn, Norway, where it is found in Zircon-sienite.

4. Very small, iron-black crystals, of a prismatic form, which gave with the common goniometer M on M = about 100°, are found with the Green Feldspar in sienite, at Beverly, (Mass.) These prisms have their lateral edges truncated. Hardness = 6 5. Streak brown; lustre me-

tallic. Infusible before the blow-pipe, alone; with salt of phosphorus, very slowly soluble, and the globule assuming a yellowish color.

POLYSPHÆRITE.

In single rounded balls or drops, whose internal structure is concentric.

Lustre resinous. Color, liver-brown, clove-brown, yellowish-brown, yellowish grey, and nearly isabella-yellow. Streak white. Hardness (scale of BREITHAUPT) = 4·0. Sp. gr. = 5·89... 6·092.

1. It is composed of oxide of lead, phosphoric acid, and alumina.

2. It is taken occasionally from diggings in the district of Freiberg: it is also found at Georgenstädter.

POONAHLITE.

Primary form. Right rhombic prism. M on M′ = 92° 20′. Lustre vitreous. Color white. Transparent... translucent. Hardness nearly that of Mesotype.

1. It is found implanted upon, and traversing Apophyllite, and associated with Stilbite, Epistilbite and Calcareous Spar, at Poonah in the East Indies.

PRASE. (See *Quartz*.)

PREHNITE. Axotomous Kouphone-Spar. MOHS.

Primary form. Right rhombic prism. M on M′ = 99° 30′.

Secondary forms.

Fig. 339.

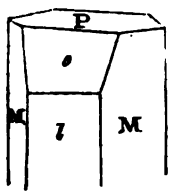
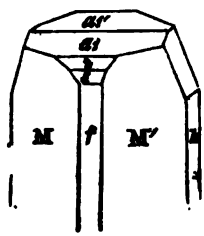


Fig. 340.



Prehnite.

o on *o* over the summit	-	31°	00′	
M or M′ on *f*	-	139	45	PHILLIPS.
*a*1′ on *a*1′	-	177	20	"
*a*1′ on *f*	-	92	00	"
*a*1′ on M	-	91	30	"
c on M	-	128	30	"

Cleavage, very distinct in the direction of P, less distinct in that of M. Surface, P and *a*1 often streaked, the lateral faces streaked perpendicularly.

Lustre vitreous, except upon P, which possesses pearly lustre, particularly if produced by cleavage. Color, various shades of green, as leek-green, mountain-green, apple-green, siskin-green, &c.; passing into white and grey. Streak white. Semi-transparent... translucent.

Brittle. Hardness =6·0...7·0. Sp. gr. =2·926.

Compound Varieties. Reniform, globular, stalactitic shapes: surface generally drusy; composition columnar, sometimes broad, imperfect and strongly coherent; if the particles of composition be distinct, the surface is often pretty smooth. Massive: composition either columnar, as above, or granular, and even sometimes impalpable. Sometimes compound varieties are again aggregated in a second composition, the faces of composition being rough and uneven.

1. Before the blow-pipe, upon charcoal, it is transformed into a white frothy scoria, which, on a continuance of the heat, melts into a compact, colored globule. With borax, it melts into a transparent bead. In dilute muriatic acid, it is slowly dissolved, leaving behind a flaky residue. When heated, it exhibits electric poles.

Prehnite.

2. *Analysis.*

	By KLAPROTH. fr. Cape of Good Hope.	By WALMSTEDT. fr. Dunbarton.	By LAUGIER. fr. the Palatinate.
Silica	43·33	44·10	42·50
Alumina	30·33	24·26	28·50
Lime	18·33	26·43	20·40
Oxide of iron	5·66	0·74	3·00
Water	1·83	4·18	2·00
Potash and soda	0·00	0·00	0·75

3. It occurs in veins in granite, gneiss, and sienite; but is more common in balls, irregular veins and vesicular cavities in trap.

4. It was first brought to Europe by Col. PREHN, from the Cape of Good Hope, in bright colored apple-green varieties. The crystallized varieties come from the Alps of Savoy and Dauphiny. Massive and imperfectly crystallized specimens occur at St. Gothard in Switzerland, in the Tyrol, in Salzburg, Carinthia, in the Pyrenees, in Norway and Sweden. It occurs in considerable quantity near Glasgow in Scotland, also at Reichenbach near Oberstein in the Palatinate, and in the Faroe Islands. In the United States, handsomely crystallized and massive varieties, of a rich green color, are found at Farmington, (Conn.) in trap. Others, less beautiful, are found occasionally throughout the trap region of New England and New Jersey. It occurs in veins in gneiss, at Bellows Falls, (Vt.) and at Charlestown, (Mass.) in sienite.

PRISMATOIDAL COPPER-GLANCE.

Primary form. Right rhombic prism.

Secondary form. The primary, having the acute lateral edges truncated, and the acute solid angles so deeply truncated, as to produce dihedral summits.

Cleavage parallel with the secondary lateral planes, rather perfect, though interrupted. Fracture imperfectly conchoidal. Surface rough.

Lustre metallic. Color blackish lead-grey. Streak unchanged.

Brittle. Hardness = 3·0. Sp. gr. = 5·785.

Compound Varieties. Massive: composition granular, individuals strongly connected.

1. Before the blow-pipe, it gives nearly the same results as Bournonite, with which it appears to agree in chemical composition.

Proustite.

2. It has been found in the beds of Spathic Iron at St. Gertraud, near Wolfsberg in the valley of the Lavant, in Carinthia.

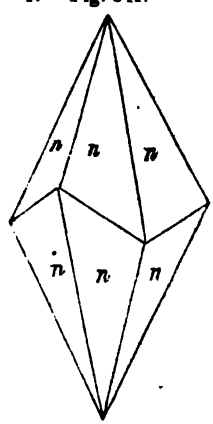
3. With the exception of form, which, however, has not been satisfactorily determined, it resembles very closely the species Bournonite.

PROUSTITE. Aphotistic Melacone-Blende.

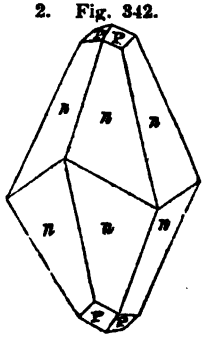
Primary form. Rhomboid. P on P=107° 36′.

Secondary forms.

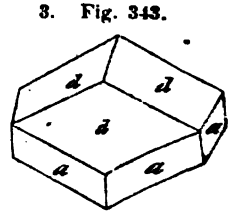
1. Fig. 341.



2. Fig. 342.

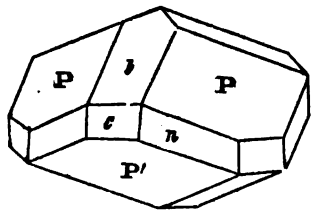


3. Fig. 343.



Proustite.

4. Fig. 344.



5. Fig. 343, with the edges between *d* and *d* truncated.

Cleavage, parallel with P rarely distinct. Fracture conchoidal . . . uneven. Surface, *d* streaked parallel to its upper edges; *a*, vertically.

Lustre adamantine. Color cochineal-red. Streak the same as color. Semi-transparent to translucent on the edges.

Hardness $=2{\cdot}0 \ldots 2{\cdot}5$. Sp. gr. $=5{\cdot}524$, a cleavable variety from Annaberg; $5{\cdot}422$, a dark red variety, from the Churprinz mine near Freiberg.

Compound Varieties. Twin-crystals, and massive, composition granular, of various sizes of individuals.

1. When heated before the blow-pipe, it decrepitates at first; it then melts with a bluish flame, emitting sulphurous acid, and in a more powerful heat, the odor of arsenic; and finally yields a metallic globule, which is reducible to pure silver. Its solution in nitric acid, gives a citron-yellow precipitate of sulphate of arsenic.

2. *Analysis.*

By Rose. from Joachimsthal.		By Proust.	
Sulphur	19·51	Sulphuret of arsenic	25·00
Antimony	0·69	Sulphuret of silver	74·35
Arsenic	15·09	Oxide of iron	0·65
Silver	64·67		

3. It occurs associated with various ores of silver, several species of Pyrites, and particularly with Native Arsenic and White Iron-Pyrites.

4. It is found in the Saxon and Bohemian mines, and is particularly abundant at Zacatecas in Mexico.

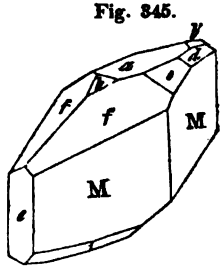
PRUNNERITE. (See *Calcareous Spar.*)

PSEUDO-MALACHITE. Hemi-prismatic Copper-Baryte.

Primary form. Oblique rhombic prism. M on M = 142° 30′.

Secondary form.

Fig. 345.



b on *e*	-	-	-	141°	4′
o on *o* over *a*	-	-	-	112	37
a on *e*	-	-	-	90	00
f on *f*	-	-	-	117	49

Cleavage. Slight indications parallel to *b′* and *e*. Fracture small conchoidal, uneven. Surface, *a* and *f* a little rough, though even; M smooth but uneven. The rest of the faces smooth and even.

Lustre adamantine, inclining to vitreous. Color emerald-green, verdigris-green, blackish green, often darker at the surface. Streak green, a little paler than the color. Translucent, often only on the edges.

Brittle. Hardness = 4·5 ... 5·0. Sp. gr. = 4·205, a crystallized variety, from Rheinbreitbach near Bonn.

Compound Varieties. Reniform, rather imperfect: composition imperfectly columnar; surface drusy, and often of a darker color. Massive: composition as above.

1. Before the blow-pipe, it melts with ease, and is converted into a small, vesicular, metalloidal globule. It is soluble without effervescence, in nitric acid, particularly if heated.

2. *Analysis.*

	By Klaproth.	By Lunn.
Oxide of copper	68·13	62·847
Phosphoric acid	30·95	21·687
Water	0·00	15·454

3. It is found in veins traversing greywacke slate, and is accompanied by several varieties of Quartz and ores of copper, in the Virneberg near Rheinbreitbach on the Rhine.

PSILOMELANE. Uncleavable Manganese-Ore. Mohs.

Regular forms and cleavage unknown. Fracture not observable.

Lustre imperfectly metallic. Color bluish-black and greyish black, passing into dark steel-grey. Streak brownish black, shining. Opake.

Brittle. Hardness = 5·0 ... 6·0. Sp. gr. = 4·145, a botryoidal variety.

Compound Varieties. Reniform, botryoidal, fruticose: composition columnar, impalpable; fracture flat conchoidal, even; in a second curved composition it is curved lamellar, the faces of composition being smooth, rough or granulated. Massive: composition granular, impalpable, strongly connected; fracture flat conchoidal, even.

Analysis.
By TURNER.

	fr. Schneeberg.	fr. Romanecha.
Red oxide of manganese	69·795	70·967
Oxygen	7·364	7·280
Baryta	16·365	16·690
Silica	0·260	0·950
Water	6·216	4·130

The only European locality quoted, is Schneeberg, Saxony, though it probably exists at several other places. Very well characterized specimens are found in considerable quantity, at Chittenden, (Vt.)

PURPLE COPPER. (See *Phillipsite.*)

PYCNITE. (See *Topaz.*)

PYKNOTROP.

Massive: cleavage in two directions, but indistinct. Fracture splintery.

Lustre vitreous. Color greyish white, to brown and grey. Translucent.

Hardness = 2·5 . . . 3·0. Sp. gr. = 2·609 . . . 2·669.

1. It is probably a variety of Serpentine.

PYRALLOLITE. Prismatic Tabular-Spar.

Primary form. Rhombic prism. M on M = 94° 36′.

Cleavage, distinct parallel to M, also to the diagonals of the prism.

Massive: composition granular. Fracture earthy.

Lustre resinous. Color white, sometimes greenish. Translucent on the edges . . . opake.

Hardness = 3·5 . . . 4·0. It seems to become harder by exposure to the air. Sp. gr. = 2·55 . . . 2·60.

1. Before the blow-pipe, it first becomes black, then white; afterwards it intumesces and melts on its edges. With borax it yields a transparent glass. When reduced to powder, it phosphoresces, with a bluish light.

2. *Analysis.*

By NORDENSKIOLD.

Silica	56·62
Magnesia	23·38
Alumina	3·38
Lime	5 58
Oxide of iron	0·99
Protoxide of manganese	0·99
Water	3·58
Bitumen and loss	6·38

3. It occurs at Storgard in the parish of Pargas in Finland, with Feldspar, Augite, Sphene and Calcareous Spar.

PYRANEITE. (See *Garnet.*)

PYRARGILLITE.

In crystals, which are four-sided prisms with truncated angles, and massive.

Color blackish, and shining.

Hardness = 3·5. Sp. gr. = 2 505.

It emits a clayey odor.

1. *Analysis.*

By NORDENSKIOLD.

Silica	43·93
Alumina	28·93
Protoxide of iron	5·30
Magnesia, with some protoxide of manganese	2·90
Potash	1·05
Soda	1·85
Water	15·47

2. It is found in Finland.

PYROCHLORE. Pyrochlore Eruthrone-Ore.

Primary form. Regular octahedron.

Fracture conchoidal.

Lustre resinous to vitreous. Color reddish-brown. Streak clear-brown. Opake.

Hardness = 5·0 . . . 6·0. Sp. gr. = 4·2.

1. Alone, it becomes of a clear, yellowish brown color, and melts with much difficulty, into a blackish-brown, slaggy mass. With borax, it is perfectly dissolved in the oxidation fire, into a reddish-yellow, transparent glass, which, by flaming, becomes yellow and opake. In the reducing heat, a dark red pearl is obtained. In salt of phosphorus, it is dissolved perfectly, attended at first, with some effervescence. With soda, upon platina, it affords a green manganesious reaction.

2. *Analysis.*

By Wohler.

Titanic acid	62·75
Magnesia	12·85
Protox. of uranium	5 18
Oxide of cerium (impure)	6·80
Oxide of manganese	2·75
Oxide of iron	2·16
Oxide of tin	0·61
Water	4·20

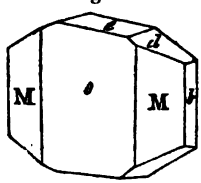
3. It is found at Friederichsväirn in Norway.

PYROLUSITE. Prismatic Manganese-Ore. Haidinger.

Primary form. Right rhombic prism. M on M = 93° 40′.

Secondary form.

Fig. 346.



Cleavage, parallel to M and *b*.

Lustre metallic. Color iron-black; in very delicate columnar compositions, the color becomes bluish, and the lustre imperfectly metallic. Streak black. Opake.

Pyrolusite.

Rather sectile. Hardness = 2·0 ... 2·5. Sp. gr. = 4·94, from Elgersburg; 4·819. TURNER.

Compound Varieties. Reniform coats. Both columnar and granular composition is often met with, particularly the former; the individuals often radiating from common centres. If the individuals are very delicate, the masses will soil the fingers, and write on paper.

1. Before the blow-pipe, it gives the customary reaction of manganese-ores.

2. *Analysis.*

By TURNER.

Red oxide of manganese	85·617
Oxygen	11·599
Water	1·566
Silica	0·553
Baryta	0·665
Lime	a trace.

3. Pyrolusite is very often the product of decomposition from Spathic Iron, the carbonate of iron of the latter being converted by natural agents, into the hydrate of the peroxide, while the lime, which it occasionally contains, is deposited in the shape of Calcareous Spar, or Arragonite; and the Manganese is often found covering the surface of decomposed rhomboids of the original species, in the shape of minute crystals. In this manner, it occurs in the mines of decomposed Spathic Iron, in beds in gneiss, at Hüttenberg in Carinthia, at Schwalkalden in Hessia, and other places. It is likewise found in this manner in the counties of Sayn, Siegen, Salm, and Hamm in Prussia, in the veins of Spathic Iron traversing clay slate, which are decomposed in the upper levels, and then contain much Limonite. One of the varieties from Horhausen is particularly remarkable for the delicacy of the fibres, which are disposed in small tufts, within the geodes of Limonite, and which greatly resemble the fibrous varieties of Grey Antimony. Weyer in the county of Wied-Runkel, Hirschberg near Ahrensberg and Beodorf on the Lower Rhine, are likewise quoted as localities of superb specimens of Pyrolusite. The finest crystals of Pyrolusite, occur at Schimmel and Oslerfreude near Johanngeorgenstadt, and at Hirschberg in Westphalia. These are chiefly short thick prisms, terminated on their extremities in

numerous fibres. Large flattish crystals, of great beauty, terminating in sharp elongated pyramids, with curved faces, occur at Maeskamezl, near Maggar Lapos, south of Kapnik in Transylvania, in geodes of Limonite, and associated with crystals of Quartz. Cleavable individuals, of considerable size, are found near Goslar in the Hartz, in a mountain called Gingelsberg. They are imbedded in small veins of Quartz and Calcareous Spar, in clay slate. Distinct, though small crystals, are met with in many of the mines in the west of Germany. A variety occurs at the mine of Antonio Pereira near Villa Ricca in Brazil, along with Limonite and Psilomelane. Small granular Pyrolusite occurs in Dalecarlia, Sweden. But the individuals are often much smaller, and appear in the form of a black sooty substance. Such are frequently found in the iron mines of Raschau, and other places in Saxony. The Pyrolusite is rarely found without Psilomelane; and is also very generally associated with Limonite. In some varieties from Berge in the county of Salm, thin stalactites of Limonite are uniformly covered with a stratum of Pyrolusite. Pyrolusite occurs at numerous places in England.

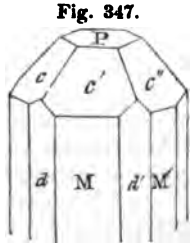
It is very abundant in the United States. It occurs at Bennington, Monkton, Chittenden, and various other places in Vermont, crystallized and granular, and associated with Psilomelane; in Massachusetts, at Conway, in a vein of Quartz; at Winchester, (N. H.); in Connecticut, at Salisbury and Kent, in thin velvety coatings, upon Limonite.

PYROMORPHITE. Brachytypous Lead-Baryte. Partsch.

Primary form. Regular hexagonal prism.

Secondary form.

Fig. 347.



Pyromorphite.

M or M′ on d'	- -	150° 00′	PHILLIPS.
M′ on c' or M′ on c''	-	131 45	"
P on c or c''	- -	138 30	"
c' on c or c''	- -	110 5	"

Cleavage, traces parallel with M, also parallel with c. Fracture imperfectly conchoidal, uneven. Surface, M almost always horizontally streaked, and often barrel-shaped, or contracted at the ends of the prisms. P rough, and often excavated.

Lustre resinous. Color, generally green or brown. There is an uninterrupted series from various shades of white, through siskin-green, asparagus-green, grass-green, pistachio-green, olive-green, oil-green; wax-yellow, honey-yellow, orange-yellow; aurora-red, hyacinth-red; hair-brown, clove-brown; pearl-grey and ash-grey. Streak white, sometimes inclining to yellow. Semi-transparent... translucent on the edges.

Brittle. Hardness $=3{\cdot}5 \ldots 4{\cdot}0$. Sp. gr. $=7{\cdot}098$, of a green variety from Zschopau; 6·831, of a brown variety from Zimapan.

Compound Varieties. Globular, reniform, botryoidal, fruticose shapes; composition columnar; faces of composition rough, irregularly streaked, seldom smooth. Massive: composition columnar, or granular; the latter in most cases strongly coherent.

1. The green and brown varieties are separated by some mineralogists into distinct species, without sufficient reason, however, inasmuch as there are individuals whose properties form an uninterrupted series of connexion between the two.

2. Before the blow-pipe, on charcoal, it melts in the outer flame into a globule, which crystallizes on becoming cold, and changes to a brown

color. In the interior flame, the globule becomes bluish, is luminous when hot, and on cooling crystallizes with large facets of a lighter color, approaching the mother of pearl. The form produced by this crystallization has not been accurately examined, though it appears to be a regular composition of several individuals. With borax, salt of phosphorus and soda, it behaves like the oxide of lead. With boracic acid and iron, it affords phosphate of iron and metallic lead.

3. *Analysis.*

	By KLAPROTH. from Zschopau, Saxony.	By WOHLER.
Oxide of lead	78·58	82·287
Phosphoric acid	19·73	15·727
Muriatic acid	1·65	1·936
Oxide of iron	0 00	0·10	a trace.

By KERSTEN.

Locality.	Sp. gr.	Chloride of Lead.	Fluoride calcicum.	Phos. of lime.	Phos. of lead.	Oxide of iron.	Total.
Sonnenwirbel	6 092	10·838	1·094	11·053	77·015	0·00	100·000
Mies (mas've)	6·444	10·642	0·248	7·457	81·451	trace	99·998
do. (crystals)	5·983	9·664	0·219	0·848	89·268	0·00	99·999
Bleisdadt (do.)	7·009	9·918	0·137	0·771	89·174	0·00	100·000
England (do.)	0·000	10·074	0·130	0·682	89·110	0·00	99·996
Poullaouen (do.)	7·048	10·090	0·000	0·000	89·910	trace	100·000
do. (mas've)	7·050	10·069	0·000	0·000	89·931	trace	100·000

4. It is found in veins in various rocks, usually attended by *Galena*, various salts of lead, Blende, Fluor and Quartz; sometimes also by different ores of silver.

Finely crystallized varieties are found at Zschopau, and other places in Saxony; at Przibram and Mies in Bohemia; in various parts of England, and at the lead hills of Scotland; also in Siberia. The brown varieties occur at Poullaouen and Huelgoet in Brittany, at Wanlockhead in Scotland, at Mies and Bleistadt in Bohemia.

In the United States, handsome specimens of the green varieties, have been found at the Perkiomen lead mine near Philadelphia, and at the lead mine in Lenox, (Maine.)

PYROPE. (See *Garnet*.)

PYROPHYLLITE.

1. Heated before the blow-pipe, it swells up, but is infusible. It yields moisture by calcination; the residue being heated with solution of cobalt, asumes a blue color.

2. *Analysis.*

Silica	59·79
Alumina	29·46
Magnesia	4·00
Oxide of iron	1·80
Water	5·62
Silver	a trace.

3. It is brought from the Ural mountains.

PYROPHYSALITE. (See *Topaz.*)

PYRORTHITE.

Massive: composition columnar. Fracture conchoidal, splintery, earthy.

Lustre resinous. Color brownish-black; if decayed, yellowish-brown. Streak brownish-black. Opake.

Hardness, is scratched by Calcareous Spar. Sp. gr. = 2·19.

1. If gently heated on one side, it takes fire, and burns without either flame or smoke; after which, it becomes white, and melts into a black enamel. It gives a transparent glass with borax; and is soluble in heated acids, with the exception of a black powder.

2. *Analysis.*

By BERZELIUS.

Silica	10·43
Alumina	3·59
Protoxide of cerium	13·92
Protoxide of iron	6·08
Yttria	4·87
Lime	1·81
Protoxide of manganese	1·39
Water	26·50
Carbon	31·41

3. It has been found at Kärarf, near Fahlun in Sweden, in a variety of granite, accompanied by Gadolinite.

PYROSIDERITE. (See *Limonite.*)

PYROSMALITE. Hexagonal Pyrosmalite-Mica. BREITHAUPT.

Primary form. Regular hexagonal prism.

Cleavage, parallel with the bases of the primary form, perfect. Fracture uneven.

Lustre pearly upon the bases of the six-sided prism; lower degrees of vitreous lustre in other directions. Color pale liver-brown, passing into grey and green. Streak paler than the color. Translucent . . . opake.

Rather brittle. Hardness = 4·0 . . . 4·5. Sp. gr. = 3·077 . . . 3·173.

1. Before the blowpipe, it becomes reddish brown, and developes fumes of muriatic acid. In a strong fire, it melts first into a black scoria, and then into a globule, which is attractable by the magnet. It is easily soluble in glass of borax.

2. *Analysis.*

By HISINGER.

Silica	35 850
Protoxide of iron	21·810
Protoxide of manganese	21·140
Muriate of iron, with excess of base	14·095
Lime	1·210
Water	5·895

3. It occurs in the iron mines of Nordmark, in Wermeland in Sweden, associated with Calcareous Spar and Pyroxene.

PYROXENE. Paratomous Augite-Spar. MOHS.

Primary form. Oblique rhombic prism. M on M = 87° 5′. (87° 42′.)

Pyroxene.

Secondary forms.

Fig. 348.

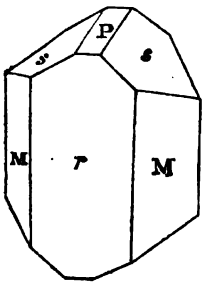
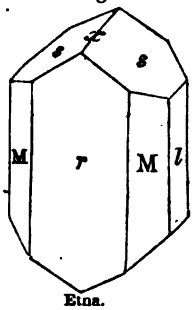


Fig. 349.



Etna.

Fig. 350.

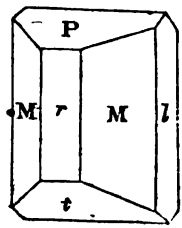


Fig. 351.

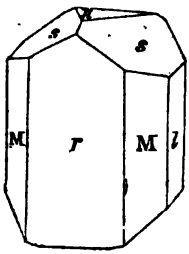
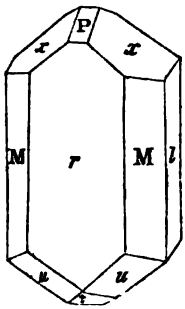
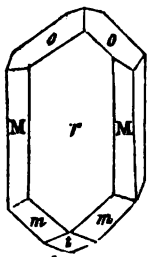


Fig. 352.



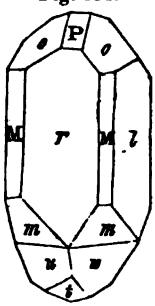
Bytown, (L. Canada.)

Fig. 353.



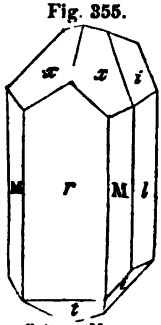
Canaan, (Conn.)

Fig. 354.



Canaan, (Conn.)

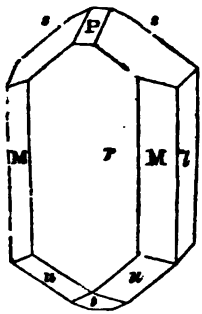
Fig. 355.



Bolton, (Mass.)

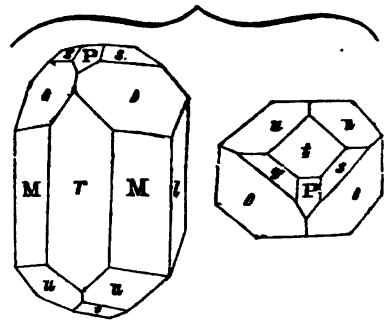
Pyroxene.

Fig. 356.



Munroe, (N. Y.)

Fig. 357.



Vla, (Piedmont.)

Fig. 348. Primary form, having the obtuse lateral edges, and the lateral angles, truncated. M on $r = 133^\circ\ 35'$. P on $s = 150^\circ\ 2'$. s on $s = 120^\circ\ 38'$. (*dihexaèdre.* H.)—Fig. 349. The same, having the lateral solid angles more deeply truncated, and the acute lateral edges truncated. M on $l = 136^\circ\ 15'$. s on $l = 138^\circ\ 48'$. (*triunitaire.* H.)—Fig. 350. The primary form, having the acute solid angle, the obtuse, and the acute, lateral edges, truncated. P on $t = 148^\circ$. r on $t = 106^\circ\ 6'$. (*quadrioctonal.* H.)—Fig. 351. Fig. 349, with the acute solid angles replaced by single planes. n on $r = 90^\circ$.—Fig. 352. r on $t = 106^\circ\ 6'$. u on $u = 131^\circ\ 8'$. x on $r = 126^\circ\ 36'$. M on $x = 134^\circ\ 17'$.—Fig. 353. M on $o = 145^\circ\ 9'$. o on $r = 118^\circ\ 59'$. o on $o = 95^\circ\ 28'$. r on $m = 133^\circ\ 30'$.—Fig. 355. i on $l = 139^\circ\ 7'$. i on $i = 81^\circ\ 46'$. (*épéméride.* H.)—Fig. 356. r on $s = 103^\circ\ 59'$. (*octoduodecimal.* H.)—Fig. 357. o on $s = 156^\circ\ 39'$. (*stenonome.* H.)

Cleavage, parallel with M, rather perfect, but interrupted; also with r and l, and sometimes parallel with s. In some varieties, it is eminent in the direction of P. Frac-

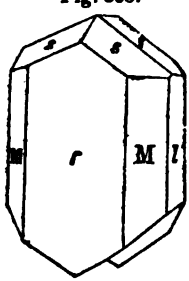
ture conchoidal, sometimes perfect . . . uneven. Surface, *r* striated vertically, P sometimes rough.

Lustre vitreous, inclining to resinous. Color green, often inclining to brown, and passing into grey and white, and also into black. Streak white . . . grey, corresponding to the color. Transparent to opake.

Brittle. Hardness = 5·0 . . . 6·0. Sp. gr. = 3·349, an ash-grey variety.

Compound Varieties. Twin-crystals: face of composition parallel, axis of revolution perpendicular to *r*.

Fig. 358.



Sometimes crystals of this kind are in cruciform aggregations. Massive varieties, compound in the direction of P, as in Sahlite; this must not be taken for cleavage, as it does not continue throughout the whole mass, but only produces more or less thick laminæ, often separated from each other by some extraneous substance: it often possesses a slight pearly lustre: there is also composition parallel *r*, as in Mussite. Massive: composition granular, of various sizes of individuals, often but slightly cohering, but often also, very intimately connected; faces of composition rough. The individuals of lamellar and columnar varieties, are in

most cases easily separated, and present striated faces of composition.

1. The present species embraces a large number of varieties, both simple and compound, among which there exist uninterrupted transitions. *Augite* comprehends opake varieties, the colors of which are black, or blackish green. One of its subdivisions, *foliated* Augite, occurs in imbedded crystals. *Conchoidal* Augite refers to imbedded grains, whose fracture is perfectly conchoidal; *common* Augite occurs also in grains, but having an uneven fracture. Foliated Augite is transformed, by decomposition, into those earthy masses, which have been called crystallized green-earth. *Coccolite* is of rather paler shades of green colors than the preceding varieties, and consists of very distinct granular particles of composition, which may be easily separated. The colors of *Sahlite*, are generally paler green, and inclining to grey; it is faintly translucent on the edges, though there are some varieties of it, as black and opake as Augite. It is compound, parallel to the face of P. If the colors become very pale, it passes into *Diopside*, which contains greenish grey, greenish white, &c. semi-transparent, crystals, or massive varieties, also of pale colors, and compound parallel to the face of r. *Baikalite* cannot be distinguished from Sahlite, even by such slight marks as those just quoted, and *Fassaite* is the name of those varieties which unite the green colors of Sahlite, or some that incline still more to yellow, with crystalline forms similar to those of Diopside. *Omphazite* is a compact, leek-green variety, with an imperfectly conchoidal or splintery fracture, and generally mixed with Garnet. That variety, called *Green Diallage*, is grass-green, either crystallized or massive, and in the latter case, it presents a granular structure, or is compound parallel to P, or to r, alternating in layers, with particles of Hornblende of the same color. Very delicate crystals produce a kind of Asbestus, which is different from the one in connexion with Hornblende, and different also from Picrolite and Picrosmine.

2. Before the blowpipe, it melts pretty easily, and emits a few bubbles; it finally yields a glassy globule, more or less intensely colored by iron. It is readily dissolved by borax. Several varieties of the present species have been obtained by way of fusion. Black crystals are not unfrequent among the slags from the iron furnaces of Sweden. A white variety, in perfect crystals, has been obtained by mixing silica, lime and magnesia, in the necessary proportion, and exposing the mixture, in a charcoal crucible, to the heat of porcelain furnaces. Many varieties of

Pyroxene.

Pyroxene, if melted, and then allowed to cool slowly, crystallize and assume an appearance little different from what they had before.

3. *Analysis.*

Analysts.	Varieties, and localities.		Magnesia.	Silica.	Alumina.	Lime.	Oxide of iron.	Ox. of manganese.	Water.	Total.
LAUGIER.	*Diopside.*	Piedmont.	18·25	57·50	0·00	16·50	6·00	0·00	0·00	98·25
LOWITZ.	*Baikalite.*		30·00	44·00	0·00	20·00	6·00	0·00	0 00	100·00
ROSE.	Black.	Orijerwi.	18·00	54.64	0 00	24·94	1·08	2·60	0·00	100·26
"		Langbanshytta.	16·99	55.32	0·00	23.01	2·16	1·59	0·00	99 07
VAUQUELIN.	"	Etna.	10·00	52·00	3·33	13·20	14·66	2·00	0·00	95·19
KLAPROTH.	"	Rhöngebirge.	12·75	52·00	5·75	14·00	12 25	0·25	0·25	97·25
"	"	Frescati.	8·75	48·00	5·00	24·00	12·00	1·00	0·00	98·75
BONSDORFF.	White.	Tammara.	18·55	54·83	0·28	24·76	0·99	trace.	0·00	99·41
HISINGER.		Langbanshytta.	17·81	54·18	0·00	22·72	2·18	1·45	0·00	98·34
NORDENSKIÖLD.	Bluish green.	Pargas.	22·57	55 40	2·83	15·70	2·50	0·43	0·00	99·43
"	Brown.	"	12·01	51·80	6·56	19·07	6·92	0·00	1·02	97·38
VAUQUELIN.	*Coccolite.*		10·00	50·00	1·50	24·00	7·00	3·00	0·00	95·50

4. Pyroxene occurs in imbedded crystals, in various kinds of rocks, in basalt, lava, &c.; also in beds in older rocks, both in crystals and in compound massive varieties; it enters into the regular mixture or composition of several rocks, as the pyroxene rocks, some varieties of greenstone and basalt; it is likewise found in veins, traversing primitive rocks. Fo-

liated, conchoidal, and common Augite, are found in the first kind of these repositories; granular Augite, Coccolite and Sahlite, occur in the second, and are associated with ores of iron and titanium, Hornblende, Epidote, Feldspar, Scapolite, &c. Omphazite occurs in beds, with Quartz, Garnet and Hornblende; Diopside in veins, traversing serpentine, with Garnet and Mica; and Fassaite and Baikalite also seem to occur in veins, when they are accompanied by Limestone.

5. The imbedded varieties of Augite are found almost in every kind of basalt, and those rocks which are allied to it. The largest crystals occur near Aussig in Bohemia; but it is met with also in the Rhön and Vogel mountains in Germany, in France and Italy, in Scotland and its western islands, &c. Granular Augite and Sahlite are chiefly obtained from Arendal in Norway, and Sahla in Sweden; Baikalite from the mouth of the Sljamanka river, that falls into lake Baikal. Diopside is found in Piedmont; Fassaite in the valley of Fassa in the Tyrol, and in the Bannat of Temeswar; Omphazite in the Saualpe in Carinthia, and near Hof in Bayreuth. The beautifully green varieties of granular Pyroxene occur in the Bacher mountain in Lower Stiria; the crystallized green-earth in the valley of Fassa in the Tyrol. The black mineral found in certain meteoric stones, appears to belong to the present species.

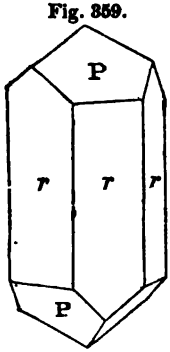
One of the most interesting localities of Pyroxene in North America, is at Bytown, Lower Canada, where it occurs, in white semi-transparent crystals, disseminated through Calcareous Spar: the crystals are an inch in diameter, and one and a half inches long, of the form of Fig. 352. The cleavage parallel with P is effected with perfect facility, and the whole crystal streaked parallel with that face. Handsome crystals of Diopside occur in the limestone quarry of Bolton, (Mass.); and very distinct crystallizations of dark green Augite and Sahlite have been found in veins at the iron-mine of Munroe, (N. Y.) Black crystals occur in the trap of Montreal. The white variety, in large, though often imperfect forms, abounds at Canaan, (Conn.) in the Dolomite beds; also at Kingsbridge, (N. Y.) with white Hornblende. Massive Sahlite, in large individuals, abounds at the Verd Antique quarries of West Haven and Milford, (Conn.); also at Bolton, (Mass.): at the latter place, masses compound in the direction of P and *r*, at the same time, are sometimes observed. A dark green imperfectly crystallized Pyroxene, abounds at Rogers' Rock upon lake George, near Ticonderoga, (N. Y.) where it is imbedded in Feldspar, and associated with Sphene and Plumbago. Coccolite, of a handsome green color, exists at Willsborough, (N. Y.) in a vein with granular Garnet and Tabular Spar. Granular Pyroxene exists also at Munroe, (N. Y.)

QUARTZ. Rhombohedral Quartz. MOHS.

Primary form. Rhomboid. P on P = 94° 15′.

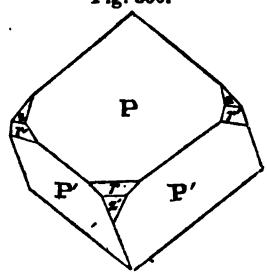
Secondary forms.

Fig. 359.



Compostella, (Spain.)

Fig. 360.



Chesterfield, (Mass.)

Fig. 361.

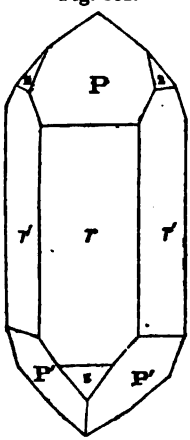
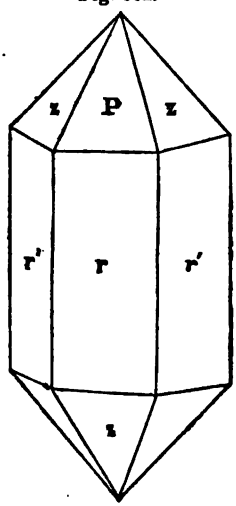


Fig. 362.



Quartz.

Fig. 363.

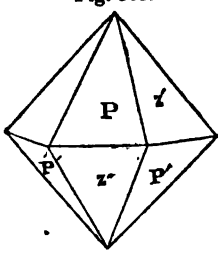
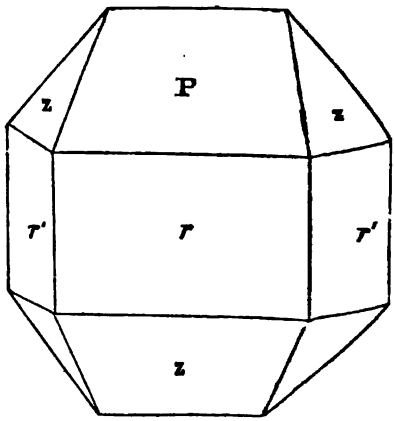


Fig. 364.



Paris, (Me.)—Fairfield, (N. Y.)

Fig. 365.

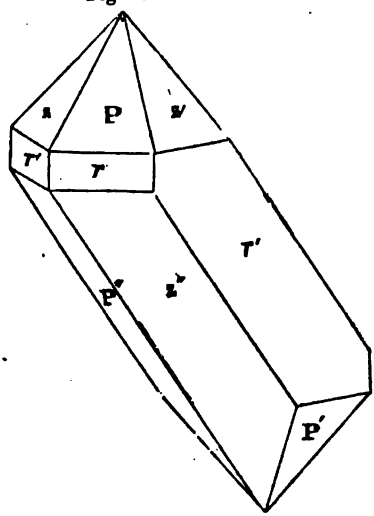
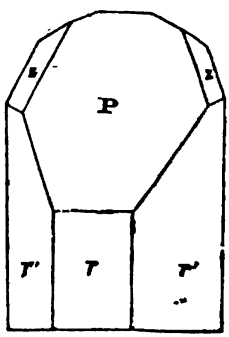


Fig. 366.

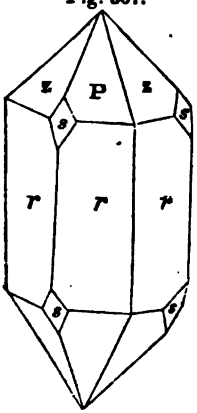


Switzerland.

Fairfield, (N. Y.)

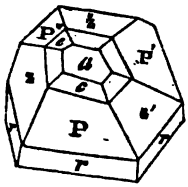
Quartz.

Fig. 367.



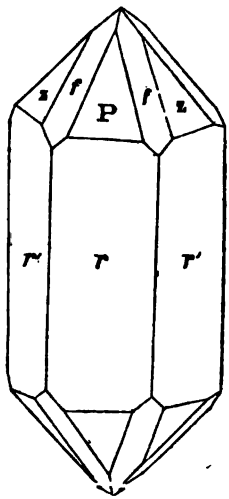
Fairfield, (N. Y.)

Fig. 368.



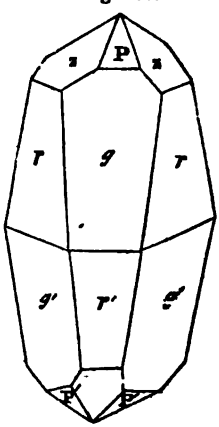
Fairfield, (N. Y.)

Fig. 369.



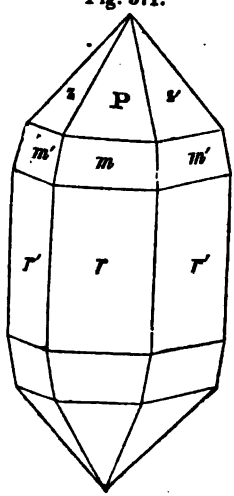
Quebec.

Fig. 370.



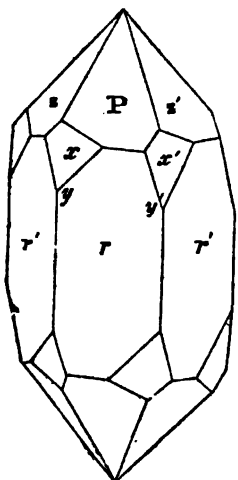
Alps.

Fig. 371.



Quartz.

Fig. 372.



White Mountains, (N. H.)

Fig. 373.

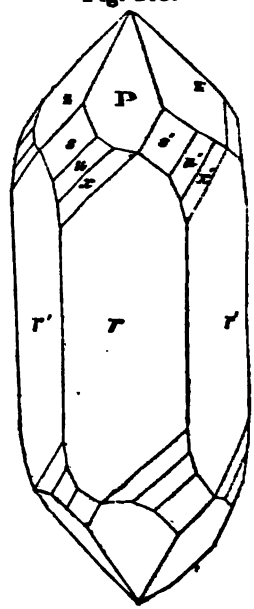
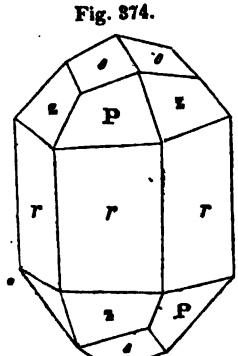


Fig. 374.



Quebec.

Fig. 359. The primary form, having its lateral angles deeply truncated, so as to produce a long prism. P on *r* =141° 40′.—Fig. 360. The primary form, having its lateral angles replaced by tangent planes, (*r*,) and by triangular planes resting on the upper edges of the rhomboid. P on *z* =133° 48′. *r* on *z* =141° 40′.—Fig. 361. The same, in which the planes *r* are much extended. (*prismé bisalterne.* Hauy.) A common form.—Fig. 362. The same, in which the planes *z* have the same size with P. (*prismé.* Hauy.) A common form, but rarely perfectly regular in the size of similar planes.—Fig. 363. The same as Fig. 361, with the omission of *r*. P on *z″* =103° 20′. (*dodécaèdre.* Hauy.) Rare.—Fig. 364. Similar to Fig. 361, but having two opposite sides of the prism, and the adjacent pyramidal faces unduly extended. (*prismé comprimé.* Hauy.) Not very common.—Fig. 365. Similar to Fig. 363, but having two adjacent faces of the prism unduly extended. (*prismé sphalloide.* Hauy.)—Fig. 366. Similar to Fig. 361, but having one face of the pyramid unduly extended. (*prismé haloide.* Hauy.) Common.—Fig. 367. Similar to Fig. 361, with the addition of the rhomboidal truncations of the alternate lateral, solid angles. *r* on *s* =142°. P on *s* =151° 7′. Common.—Fig. 368. P on *a* =145° 22′. *c* on *a* =159° 50′. *c* on P =165° 30′. *z″* on *a* = 111° 15′. *z* on *a* = 137° 51′. *z* on *e* =145° 30′. *a* on *e* =175° 30′. Very rare.—Fig. 369. Fig. 361, having the edges of the pyramids truncated. *f* on *z* =141° 40′. (*emarginé.* Hauy.) Very rare.—Fig. 370. *r′* on *g* =178° 32′. P on *g* =143° 32′. (*hyperoxide.* Hauy.)—Fig. 371. Fig. 361, with the terminal edges of the prism replaced by single planes. *r* on *m* = 168°

49′. P on *m* =152° 51′. (*pentahexaèdre.* HAUY.) Rare. —Fig. 372. *r* on *x* =167° 56′. *z* on *x* =125° 11′. P on *x* =148° 42′. (*plagièdre.* HAUY.) Rare.—Fig. 373. Similar to Fig. 372, with the addition of the rhomboidal truncations of Fig. 367, and the replacement of the edges between *s* and *x*; *s* and *x* =152° 13′. *u* on *x* =173° 33′. (*co-ordonneé.* HAUY.) Very rare.—Fig. 374. P on *o* = 160° 15′. *o* on *o* =125° 10′. Very rare.

Irregular forms and grains.

Cleavage, parallel to P and *r*; but very imperfect, and interrupted by conchoidal fracture. Fracture conchoidal, sometimes highly perfect, sometimes less distinct. Surface, *a* and *x* generally rough; *r* and *z* are streaked horizontally. The rest of the faces generally smooth.

Lustre vitreous, inclining in some varieties to resinous. Color, white, prevalent; among the brightest colors are violet-blue, rose-red, clove-brown and apple-green. Dark brown and green colors, generally owing to foreign admixtures. Streak white. Transparent... translucent, frequently even opake, particularly when impure.

Hardness =7·0. Sp. gr. =2·690.

Compound Varieties. 1. Faces of composition parallel, axis of revolution perpendicular to a face of *r*; the individuals being continued beyond the face of composition. 2. Individuals joined perpendicular to the axis. Frequently large crystals are made up of alternatiug laminæ of two individuals; and often, faces of composition assume the appearance of cleavage.

Implanted globules, reniform, stalactitic shapes: surface smooth, granulated, or drusy; composition columnar, generally impalpable; often a second time composed into gran-

ular or curved lamellar masses. Massive: composition granular or columnar, and often impalpable; and then the fracture becomes conchoidal and splintery. Sometimes a second composition produces indistinctly granular, or thick lamellar masses. Certain very thin columnar compositions, if cut *en cabochon* parallel to the fibres, show an opalescent light. Pseudomorphic crystals, in the shape of cubes, octahedrons, derived from Fluor,—in the shape of rhomboids and hexagonal prisms, derived from Calcareous Spar,—and of lenticular forms, from Gypsum. Globular and tuberose masses formed in vesicular cavities. Plates. Pebbles.

1. There are several modes of occurrence among the crystals of Quartz, hitherto confined to this species, which become evident on an inspection of the forms described above. The scalene triangular faces *x* and *u* are the most remarkable in this respect. Their faces appear only to the right, or only to the left of the faces *s*. Two individuals, differing in regard to the right or left situation of these faces, cannot be brought in any such position, that all their faces become parallel; and they are different, therefore, like the right hand and the left. This difference extends even to the action of the individuals on light, as has been shown by Mr. HERSCHEL.

2. The species Quartz does not by any means abound in varieties of crystallization; and yet, owing to the disproportionate size of the faces of its forms, its crystals offer considerable diversity of appearance. The chief perplexity among the varieties of Quartz, arises from mechanical composition, and the admixtures of different substances foreign to the species. No less than thirteen different species are distinguished in the Wernerian system, to which those of other systems more or less correspond. *Quartz* contains most of its simple or crystallized varieties, and may be said to represent the species most perfectly. It contains five sub-species;—*Amethyst*, including violet-blue varieties; *Rock Crystal*, composed of the most perfectly crystallized, and some transparent, or semi-transparent, massive varieties; *Rose Quartz*, confined to translucent rose-red, and milk white, massive varieties; *Prase*, which is only of a dark leek-green color; and *Common Quartz*, at last, comprehends all those varieties, not included in any of the preceding subspecies.

Quartz.

There are several massive varieties of common quartz, which consist of granular particles of composition. If they diminish so much in size as to become impalpable, their transparency and lustre becomes diminished, and several kinds of conchoidal fracture appear, if specimens of these varieties be broken. This gave rise to new species among the early mineralogists. *Hornstone* is always compound, translucent on the edges, and either of a splintery dull fracture, or glistening and glimmering, and conchoidal. Thus *splintery* Hornstone and *conchoidal* Hornstone, are formed, and either of them may produce *Woodstone*, if it appears in the shape of petrified wood. The varieties of *common Flinty slate* are most like Hornstone, but show on a large scale, an imperfect slaty fracture, and various dirty grey colors; those of *Lydian stone*, which form the second kind of flinty slate, possess an even, glimmering fracture, and a greyish-black color. Flint is a compound mineral, like the two preceding ones, but translucent, at least on the edges, and possesses a perfect, flat conchoidal, glimmering fracture. *Float-stone*, a variety of Quartz, which has likewise been considered as a particular species, consists of a delicate tissue of minute crystals, visible under a powerful magnifier, and demonstrates hornstone and flint, (into which it insensibly passes, by having its grain closer, and of which it often contains nodules,) to be varieties of the same natural-historical species. Common Quartz is sometimes found in reniform and stalactitic shapes, consisting of granular particles of composition, sufficiently large to be observed and separated from each other. If the thickness of these individuals be so much diminished, that at last they become impalpable, the different varieties of Calcedony are formed, occurring in the above mentioned external shapes. The difference in the colors of these, has given occasion to the distinction of *common Calcedony*, and of *Carnelian*; the former of which comprehends greyish colors, or in general such as do not possess bright tints of colors, while the latter refers to red colors. *Common Carnelian*, moreover, occurs in globular and irregular tuberose shapes; *fibrous Carnelian* is found in reniform masses, and generally shows, very distinctly, the above mentioned composition. The rhomboidal crystals, of smalt blue color, from Transylvania, are also enumerated among the varieties of common Calcedony; probably because there exist reniform varieties of common Calcedony, possessing the same color, though they are more nearly related to common Quartz. Common Quartz also occurs in massive varieties, showing columnar composition. If they be thin, parallel, strongly coherent, and more or less bent, *Fibrous Quartz*, (a par-

ticular species of the old systems,) is formed; *Cat's eye*, (another species,) if they are nearly impalpable, and almost solely to be observed in the opalescent light, which they exhibit when cut into a convex surface. *Cat's eye* is generally greenish grey; but there are varieties of other shades, sometimes even black. It preserves a small conchoidal fracture, and is more or less translucent. If several of the preceding varieties are distinctly colored by some foreign mineral substance, or intimately mixed with it, various other pretended species are formed. *Chrysoprase* is a variety of common Quartz, consisting of small granular particles of composition, colored apple green by oxide of nickel; *Plasma* is a variety of Calcedony, colored leek-green, and almost grass green, by some substance which is not exactly ascertained. *Heliotrope*, likewise a variety of Calcedony, but mixed and colored by green earth, containing blood-red spots of Jasper. The brownish-red color of the commonly so called *Hyacinth of Compostella*, is produced by the admixture of oxide of iron. If the same thing takes place in compound varieties, the individuals of which are still recognizable, *Iron Flint* is produced; and *Jasper*, with its various kinds, is formed, if besides the oxide of iron, clay enters into the mixture; and if, moreover, the individuals can, on account of their diminutive size, be no longer recognized. *Striped Jasper* probably contains a good deal of clay, and is distinguished on account of its striped delineations. The varieties of *Egyptian Jasper*, both *Red* and *Brown*, occur in globular shapes; the latter of which are, beyond a doubt, formed in open spaces, as appears from the concentric layers of which they consist, and the drusy cavities lined with crystals of Quartz, often found in their interior. *Agate Jasper*, being less impure, is more properly referred to Hornstone. *Opal Jasper* may be said to be a variety of Opal, and does not belong to the present species; nor does *Porcelain Jasper*, which is nothing else but burnt clay.

3. Quartz is infusible before the blow-pipe, on charcoal, but with soda it is easily dissolved, with effervescence.

4. *Analysis.*

The most perfect varieties of Quartz, consist of pure silica. Bucholz obtained 99·875 of silica from Rock crystal, with traces of iron and alumina. Hornstone, Flint and Calcedony, agree with it according to various analyses. Several varieties contain small quantities of alumina, lime, oxide of iron, &c. Chrysoprase contains 0·01 of oxide of Nickel, according to Klaproth. Crystals of Quartz may be obtained as deposits from a solution of silica in fluoric acid, or in potash diluted

with water. The fluid from which crystals of this species are formed in geodes and other natural cavities of rocks, has been observed to be chiefly water; and often leaves behind it a mass resembling Opal on desiccation, when suddenly exposed to the air.

5. Common Quartz enters into the regular mixture of various rocks, of granite, gneiss, mica-slate, topaz-rock, &c. In others, they occur in single crystals, and in grains, as, for instance, in porphyry, and are frequently met with in vesicular cavities, particularly of amygdaloidal rocks. Here also are found the finest varieties of Calcedony, Carnelian, of the brown, and probably also the red, Egyptian Jasper, the agate balls, &c. Hornstone frequently forms globules in compact limestone; and Flint, globular and tuberose masses in chalk, often disposed in beds, and including petrifactions. Many varieties occur in irregular nodules and large massive concretions, in various rocks. Thus common quartz is found in all those rocks, into whose composition it enters as an ingredient, sometimes forming masses, whose interior is lined with crystals. Hornstone and Chrysoprase occur in serpentine rocks, and Fibrous Quartz and Cat's eye in some varieties of slate. Quartz also forms beds by itself, as in quartz-rock and certain kinds of sandstone. It is very frequent in all kinds of veins, where are found for the most part Amethyst, rock crystals, Hornstone and Calcedony, but chiefly common Quartz, constituting the greater part, and sometimes the whole body of the vein. The agate veins are thus found, which consist of different varieties of Quartz, alternating in various stripes or bands with each other. Rock Crystal, Amethyst, Flinty Slate, but particularly common Quartz, are found in pebbles. The river sand, and that of deserts, consists of common Quartz. It is also found filling up the space of petrified bodies, as, for instance, echinites in chalk, and petrified wood in sandstone, and in alluvial deposites.

6. The numerous varieties of the present species are spread all over the globe, but some of the most distinguished varieties are found only in a few localities. The finest and largest rock crystals are found in the Alps of Salzburg, the Tyrol, Switzerland, Dauphiny, Piedmont, and Savoy;* also in the isle of Madagascar, Ceylon and Brazil. Several vari-

* About one hundred years ago, a great drusy cavity, lined with crystals of this species, was opened in Zinken, which afforded 1000 cwt. of rock crystals, and at that early period sold for $30,000. One crystal weighed eight cwt., others from four to five cwt.

eties from Hungary and Siberia, are pale violet blue; some, called smoky-topaz, from Bohemia, are brown and yellow. The Scottish Cairngorm-crystals, sometimes possess several bright tints of these colors, in one and the same specimen. Amethysts, of various colors, are brought from Brazil; but the finest, violet-blue colors, come from Ceylon, India, and Persia, where some of them are found in pebbles. Less transparent or well colored specimens, occur in original repositories, at Porkura and other places in Transylvania, in Hungary, Siberia, &c. Some varieties are also found in Scotland, in Saxony, in the Hartz, in Bohemia, in Silesia, &c.; and they are met with in veins, in agate balls, or in secondary deposits. Rose Quartz occurs at Rabenstein near Zwiesel in Bavaria, and in Siberia; the milk-white varieties of it are known from Norway, Spain, France, &c. The locality of Prase, is Breitenbrunn in the mining district of Schwarzenberg in Saxony. Smalt blue Calcedony, sometimes crystallized, occurs at Tresztyan in Transylvania; the stalactitic and reniform shapes, occur in fine varieties in Iceland and the Faröe islands, in amygdaloid; at Hüttenberg and Loben in Carinthia, in beds of iron-stone: also in Hungary, Transylvania, in Scotland and other countries. Most beautiful specimens have been found in Trevascus mine in Cornwall. Carnelian is brought from Arabia, India, Surinam, and Siberia; it is met with also in Bohemia, Saxony, &c.; fibrous Carnelian, in Hungary; Chrysoprase, at Kosemütz in Silesia, in serpentine. It is not known from whence the ancients received the Plasma found among the ruins of Rome; but several varieties, resembling it, have been recently discovered in Moravia and Bavaria. It occurs in India, from whence it is occasionally brought in beads and other ornaments. Flint is a common mineral in England, France, the islands of Rügen and Seeland, in Poland and Spain. Near Gratz in Stiria, it occurs as one of the ingredients of gneiss. Splintery Hornstone produces the remarkable pseudomorphic crystals from Schneeberg in Saxony; it also occurs in veins in Hungary and other mining countries; in beds, it is found in Norway, and in spheroidal masses in limestone in the Tyrol. Flinty slate forms beds in numerous countries. Fibrous Quartz occurs in the Hartz; Cat's eye in Ceylon, the coast of Malabar, and also in the Hartz. Heliotrope used formerly to be brought from Ethiopia, but is now generally obtained from Bucharia, from Tartary and Siberia. Iron-flint is frequent in the iron-stone veins of Saxony, Bohemia, Hungary, Transylvania, &c.; and along with it, often also, common Jasper. Striped Jasper occurs in Siberia, at Grandisteen in Saxony, at Ivybridge in Dev-

onshire; the brown Egyptian Jasper comes from the banks of the Nile; the red variety, from Baden. The petrifactions, still preserving the rings of wood, in the shape of trunks, branches and roots, are met with in many countries, particularly in Hungary, and Antigua in the West Indies. Rare crystallizations of Quartz occur in the black limestone of Quebec; and large crystals of smoky Quartz are brought from Nova-Scotia.

The United States have not afforded very remarkable varieties of Rock crystal. The primitive mountains of New Hampshire and Vermont, produce occasionally large crystals of this variety; but their occurrence is rare. The transition limestone of New York affords at numerous places, very beautiful crystals, chiefly of the form represented in figs. 362, and 367, and which vary in dimensions from four inches in diameter, down to the smallest size. Occasionally they are somewhat smoky, and are often penetrated by anthracite. One of the oldest localities, is Diamond Island, Lake George; but that which still affords them in the greatest abundance, is Canada Creek, near Fairfield, St. Lawrence county. The granite of Chesterfield, (Mass.) contains small crystals, like fig. 360, in which scarcely any faces, excepting those belonging to the primary rhomboid, are visible. The faces are destitute of polish. The trap region of Massachusetts and Connecticut, occasionally affords the Amethyst; loose crystals of which are also found in the soil, near Bristol, (R. I.) The notch of the White Mountains, (New Hampshire,) and the Tourmaline deposit of Paris, (Me.) have both afforded handsome crystals of brown or smoky Quartz. Iron-flint occurs at Pittsfield, (Mass.) Druses of Quartz crystals, colored of a delicate apple green, occur along with Chrysoprase, at New Fane, (Vt.); Prase, at Cumberland, (R. I.); Rose Quartz, at Paris, (Me.) Southbury, (Conn.) Acworth, (N. H.); leek-green Hornstone, in rolled masses, at Amherst and Pelham, (Mass.); common Hornstone, throughout the secondary region of New York, Ohio, and other western states. Calcedony and Carnelian occur, though rarely, forming agate, throughout the trap region of Connecticut and Massachusetts; Red Jasper, at Saugus near Boston, and yellow Jasper, with Calcedony, at Chester, (Mass.); the latter found in large rolled masses. Pseudomorphous crystals, consisting of coatings over six-sided prisms, and scalene dodecahedrons, of Calcareous Spar, are found in a galena vein, at Williamsburgh, (Mass.)

7. Several varieties of Quartz are of important use in the arts and manufactures. Those possessing good degrees of transparency, or fine

colors and delineations, as Rock crystal, Amethyst, Rose Quartz, Chrysoprase, several varieties of Calcedony, called Onyx, Sard, Sardonyx, &c., are cut and polished into ring stones, seals, and various other ornaments. Agate is also used for the same purposes. The most important application, however, is that for the manufacture of glass, and pottery. It is used also as a flux in the melting of several kinds of ores. Its use in gun locks is also well known. Sandstones yield various applications for architectural and other purposes, as the construction of melting furnaces, mill-stones, &c. Sand, with slaked lime, forms mortar.

QUINCYTE.

Massive; composition granular.

Color carmine-red.

1. It loses its color by heat, and is with difficulty fusible before the blow-pipe.

2. *Analysis.*

By BERTHIER.

Silica	54·00
Magnesia	19·00
Protoxide of iron	8·00
Water	17·00

3. It is found in the fresh water limestone of Mehun and Quincy, in the department of Cher.

4. The description is too imperfect, to lead to any opinion of its specific character.

RADIOLITE.

Massive: composition columnar, particles of composition radiating: compact. Cleavage, distinct in one direction.

Lustre silky, glistening. Color white.

Hardness, above Fluor. Sp. gr. = 2 275 . . . 2·286.

1. *Analysis.*

By HUNNEFIELD.

Silica	41·88
Alumina	23·79
Soda	14·07
Potash	1·01
Water	1·00
Oxide of iron	0·91
Carbonate of lime	2·50
Gangue	5·50

2. It is found at Eckefiord in Norway.

Realgar.

Ratofkite.

An earthy, impure variety of Fluor, which, according to John, consists of

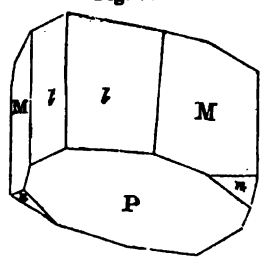
Fluate of lime	49·00
Phosphate of lime	20·00
Sulphate of lime	2·00
Phosphate of iron	3·75
Water	10·00
Insoluble matters	6·25

REALGAR. Red Malacone-Blende.

Primary form. Oblique rhombic prism. M on M= 74° 14′.

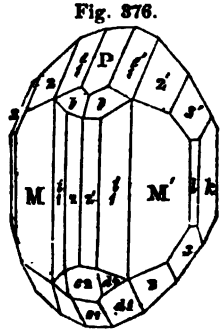
Secondary forms.

Fig. 375.



M on M	74°	30′
l on *l*	113	20
P on *l*	113	16
n on *n* over P	131	59

Fig. 376.



Realgar.

M on M	-	74°	15′	M′ on *e*′2	-	135°	2′
P on M	-	104	6	M′ on *e*′3	-	141	20
P on *b*	-	149	12	M′ on *i*1	-	172	6
P on *c*2	-	80	00	M′ on *i*2	-	160	42
P on *e*1	-	156	30	M′ on *k*	-	142	42
P on *e*2	-	138	22	M′ on *l*	-	163	35
P on *e*3	-	126	50	*c*1 on *c*2	-	150	38
P on *k*	-	90	00	*c*1 on *d*1	-	155	10
M on *b*	-	133	2	*c*1 on *d*2	-	137	20
M on *c*1	-	99	30	*c*1 on *d*3	-	125	41
M on *c*2	-	115	52	*c*1 on *k*	-	90	00
M′ on *d*1	-	119	30	*c*2 on *d*4	-	161	20
M′ on *d*2	-	131	34	*i*2 on *i*2′	-	112	55
M′ on *e*′1	-	122	50				

PHILLIPS.

Cleavage, parallel to P and the shorter diagonal of the prism, rather perfect; parallel to *n* and M less distinct. Fracture conchoidal. Surface, the prisms streaked in the direction of the principal axis, parallel to that line: the rest of the faces commonly rough.

Lustre resinous. Color, aurora-red, several shades, little differing from each other. Streak orange yellow... aurora-red.

Sectile. Hardness = 1·5 ... 2·0. Sp. gr. = 3·566.

Compound Varieties. Massive: composition granular, of various sizes of individuals, strongly connected. Fracture conchoidal, uneven.

1. Before the blow-pipe, upon charcoal, it burns with a blue flame, and emits fumes of sulphur and arsenic. It is soluble in nitric, muriatic and sulphuric acids.

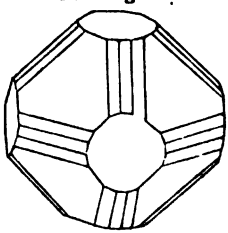
2. *Analysis.*

	By KLAPROTH.	By LAUGIER.
Sulphur - - -	31·00 - - -	30·43
Arsenic - - -	69·00 - - -	69·57

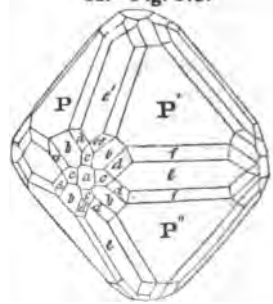
3. Some of the varieties of Realgar occur along with Orpiment, in beds of clay, as at Tajowa in Hungary. It is found in small nodules along

Red Copper-Ore.

11. Fig. 378.



12. Fig. 379.



P on P	-	-	109°	30′	PHILLIPS.
P on *a*	-	-	125	10	"
P on *b*	-	-	160	42	"
a on *b*	-	-	144	38	"
e on *e*	-	-	120	00	"

Cleavage, parallel with the primary planes, but much interrupted. Fracture conchoidal, uneven. Surface generally very smooth and shining, and every where the same.

Lustre adamantine, sometimes metallic adamantine, or imperfectly metallic. Color between cochineal-red, and in capillary crystals almost carmine-red. Streak several shades of brownish-red, shining. Semi-transparent . . . translucent on the edges.

Brittle. Hardness = 3·5 . . . 4·0. Sp. gr. = 8·992.

Compound Varieties. Massive: composition granular, individuals of various sizes, or even impalpable. In the latter case, fracture becomes flat conchoidal, or even, the surface of the fracture glimmering. Sometimes earthy.

1. Those varieties which consist of friable particles, and present an earthy fracture, and which are besides often mixed with oxide of iron or malachite, constitute the *Tile-Ore*, which was formerly considered as a

particular species, and divided into *earthy* and *indurated Tile-Ore*. *Red Copper-Ore* itself (the remaining varieties of the present species,) was divided into three subspecies—the *foliated*, which contains those crystallized varieties which are not capillary, together with compound cleavable ones; the *capillary*, which comprehends very thin filiform crystals, reticulated, or in velvety groups; and the *compact*, which refers to impalpable compositions.

2. In the reducing flame of the blow-pipe, it is reduced upon charcoal into a globule of copper. It is soluble with effervescence in nitric acid, but without effervescence in muriatic acid.

3. *Analysis.*

	By Klaproth.	By Chenevix.
Copper	91·00	88·50
Oxygen	9·00	11·50

4. It is found in beds and veins in several rocks, accompanied by various other ores of copper and iron, and by Quartz.

5. Nearly one hundred modifications of form have been observed in the crystals of Cornwall, at which place the species occurs in tin and copper veins. Handsome crystallizations also occur in the Bannat of Temeswar, in the vicinity of Moldawa; near Catharineburgh in Siberia, and at Chessy near Lyons in France. Other localities of this species are found in Prussia and Saxony, but particularly in Chili and Peru. The principal deposits of the capillary variety, are Cornwall, and Rheinbreitbach on the Rhine. Tile-Ore is found among other varieties in the Bannat, and at Camsdorf and Saalfeld in Thuringia. This species has been obtained massive, along with Chrysocolla and Native Copper, in the U. States, at Schuyler's mine in New Jersey.

Red Copper-Ore is frequently produced in the slags formed in the last process of melting copper. Copper vessels, long exposed to the action of the weather, are, to a great extent, converted into a tissue of crystals, of the present species, while the outside is covered with chloride of copper.

6. It is valuable as an ore of copper.

RED LEAD-ORE. Hemi-prismatic Lead-Baryte.

Primary form. Oblique rhombic prism. M on M′= 93° 30′.

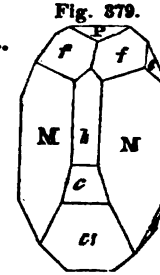
Red Lead-Ore.

Secondary forms. 1. The primary, having the obtuse terminal edges replaced by single planes, and then so far extended as to obliterate the terminal plane; the lateral edges of the prisms being replaced by tangent planes.

2. The same as the above, having in addition the acute terminal edges replaced, so as to impart four-sided summits to the crystals.

3. The same as 2, with the exception of having the oblique edges of the prism replaced, instead of the lateral, as in

Fig. 379.



P on M	-	99	10′	PHILLIPS.
P on *e*	-	119	10	"
P on *f*	-	133	00	"
P on *h*	-	102	5	"
M or M on *cl*		133	10	"
M or M on *f*		146	25	"
M or M on *h*		136	35	"
e on *f*	-	140	3	"
f on *f*	-	118	58	"

Cleavage, parallel to the primary, tolerably distinct: less so to the bases, than to the sides of the prism. Fracture small conchoidal, uneven. Surface, M streaked longitudinally. The faces mostly smooth and shining.

Lustre adamantine. Color various shades of hyacinth-red. Streak orange-yellow. Translucent.

Sectile. Hardness $=2{\cdot}5 \ldots 3{\cdot}0$. Sp. gr. $=6{\cdot}004$.

Compound Varieties. Massive: composition imperfectly columnar, or granular.

1. Before the blow-pipe, it becomes black and decrepitates, if quickly heated; it may be melted, however, into a shining slag, containing globules of metallic lead. It colors glass of borax green, is soluble without effervescence in nitric acid, and affords a yellow solution in that acid.

2. *Analysis.*

	By Pfaff.	By Berzelius.
Oxide of lead	68·00	68·14
Chromic acid	32·00	31·86

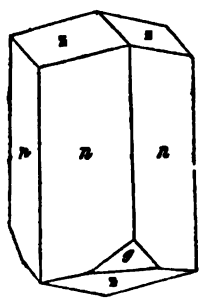
3. Red Lead-Ore has been found in Siberia, in the neighborhood of Beresof; where it occurs in narrow veins, traversing a rock, the true nature of which is not ascertained. It is accompanied by cubical crystals of Iron Pyrites, generally in a state of partial decomposition; also by Galena, several salts of Lead, and sometimes by Native Gold. In Brazil, it is met with in sandstone, probably under similar circumstances.

RED SILVER. Red Malacone-Blende.

Primary form. Rhomboid. P on P = 108° 39′ 39″.

Secondary forms.

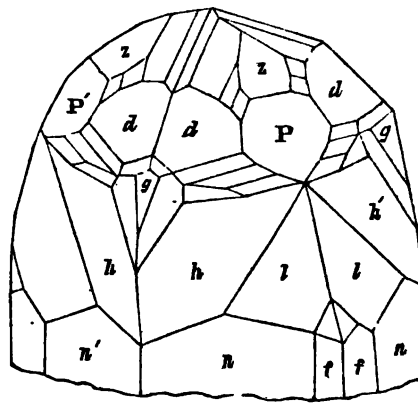
Fig. 380.



Similar to those of Proustite, (q. v.) and several others resembling the secondary forms of Calcareous Spar. Annexed is a crystal, measured by Phillips, which combines the principal modifications, under which Red Silver is seen. It is obvious from an inspection of the figure, that the planes *z* tend by their extension to the production of an obtuse rhomboid; the planes *g*, to acute rhomboids; the planes *d*, and the four planes without letters, situated

directly above them, to obtuse scalene dodecahedrons; the planes *h*, and the three sets of planes around *g*, *l* and the three elongated planes between *h* and *d*, all tend to acute scalene dodecahedrons; *f* and *n* lead to regular six-sided prisms.

Fig. 381.



P on *z* (c. g.)	-	-	-	-	172°	00′
P on *h*	-	-	-	-	141	50
P on *l*	-	-	-	-	158	22
d on *d* (c. g.)	-	-	-	-	125	
h on *h*	-	-	-	-	134	40
n on *n*	-	-	-	-	120	

Cleavage parallel with P, pretty distinct in some varieties. Fracture conchoidal. Surface, *f* and *n* striated vertically; P, *z*, and *g*, and most of the adjoining faces streaked parallel to their common edges of combination.

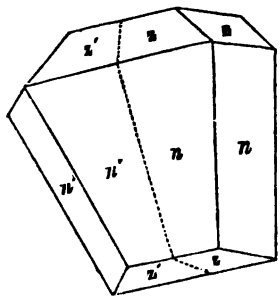
Lustre metallic-adamantine. Color, iron-black, lead-grey, sometimes approaching cochineal-red. Streak, cochineal-red, in shades corresponding to the color. Translucent to opake.

Red Silver.

Sectile. Hardness =2·5 . . . 3·0. Sp. gr. =5·787 . . . 5·844. BREITHAUPT.

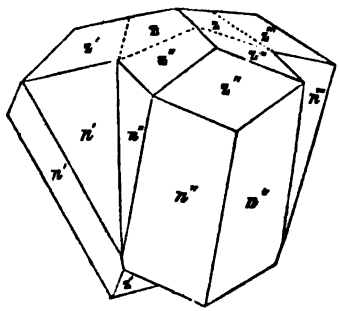
Compound Varieties. 1. Twin-crystals. Face of composition perpendicular, axis of revolution parallel, to an edge of *z*.

Fig. 382.



This kind of regular composition is frequently repeated, contiguous to all the terminal edges of *z*, as in

Fig. 383.



2. Face of composition parallel, axis of revolution perpendicular to *g*.

Red Silver.

3. Face of composition parallel to *n*, axis of revolution perpendicular to it. The individuals are sometimes continued beyond the face of composition. Massive: composition granular, of various sizes of individuals, strongly connected. If the composition becomes impalpable, fracture is uneven, even, or flat conchoidal. Plates, superficial coatings.

1. When heated before the blow-pipe, it first decrepitates, then melts, burning with a bluish flame, and emitting sulphurous acid together with the white smoke of antimony. By continuing the heat, a globule of silver is obtained. Its powder heated in nitric acid, turns black, emits red fumes, and dissolves leaving behind some sulphur and oxide of antimony. The solution yields with water a white precipitate, on the separation of which, muriatic acid occasions the deposition of chloride of silver.

2. *Analysis.*

By Bonsdorff.

A var. from Andreasberg.

Sulphur	16·609
Antimony	22·846
Silver	58·949
Earthy matter	0·299

3. It has hitherto been found in veins associated with various other ores of silver, particularly with Proustite, and Native Silver, also with Galena, Blende, and several species of Pyrites.

4. It is found in beautiful crystals, at Andreasberg in the Hartz, and is also met with at Schemnitz, Cremnitz, Nagybanya, &c. in Hungary, in Alsace and Dauphiny in France and at Kongsberg in Norway. It occurs in the greatest abundance at Zacatécas in Mexico, from whence very splendid crystallizations are procured.

5. It is of considerable value as an ore of silver. The mine of Veta-Negra, near Sombrerète, produced in the space of a few months 700,000 marcs of silver from this species.

Red Vitriol. (See *Cobalt-Vitriol.*)

RED ZINC-ORE. Hemi-prismatic Eruthrone-Ore.

Primary form. Right rhombic prism?

Cleavage, in one direction perfect, in three others less so, and apparently different in each. Two angles are afforded by the reflective goniometer, one of 125°, the other of 90°. Fracture conchoidal.

Lustre adamantine. Color red, inclining to yellow. Streak, orange-yellow. Translucent on the edges.

Brittle. Hardness =4·0...4·5. Sp. gr. =5·432... 5·523.

Compound Varieties. Massive; composition granular, individuals strongly connected.

1. On exposure to the air, it suffers partial decomposition at the surface, becoming invested with a white coating, which is carbonate of zinc. Alone before the blow-pipe, it is infusible, but yields a yellow transparent glass with borax. It is soluble without effervescence, in nitric acid.

2. *Analysis.*

	By Bruce.	By Berthier.
Oxide of zinc	92·00	88·00
Oxide of iron and manganese	8·00	12·00

3. It occurs massive, mixed with Calcareous Spar and Franklinite, at Franklin and Stirling, (N. J.) It is set free in several metallurgic processes, and occurs crystallized in six-sided prisms of a yellow color, in the foundaries of Konigshütte in Silesia.

Retinasphalt. (See *Retinite.*)

Retinite.

Roundish, and blunt-edged masses. Fracture conchoidal.

Lustre resinous. Color green, yellow, red, brown, sometimes in striped delineations. Semi-transparent to opake.

Hardness =1·5...2·0, of the variety from Halle. Sp. gr. = 1·135.

1. Retinite, if rubbed in an isolated state, acquires negative electricity. In the flame of a candle, it melts and takes fire with a particular odor. It is partly soluble in alcohol, leaving behind an unctuous residue.

2. *Analysis.*

	By Hatchett.	By Bucholz.
Vegetable resin	55·00	91·00
Asphalt or bitumen	42·00	9·00
Earthy matter	3·00	0·00

3. It has been found in the beds of earthy brown coal near Halle on the Saale; at Bovey in Devonshire, also in Upper Austria, Moravia, &c. The variety from Halle very much resembles a vegetable resin. The purer specimens frequently consist of alternating layers more or less transparent, corresponding to the external shape, and commonly including a cavity. Its Sp. gr. =1·079.

Reussin. (See *Bloedite.*)

Rhaetizite. (See *Kyanite.*)

Rhodonite. (See *Manganese Spar.*)

RHOMB SPAR. Brachytypous Lime-Haloide. Mohs.

Primary form. Rhomboid. P on P′ =107° 22′.

Cleavage, highly perfect parallel with the primary form. Fracture, often conchoidal, at right angles to the axis. Surface, even, or rather rough.

Lustre vitreous, sometimes inclining to pearly upon faces of cleavage. Color white or grey, generally inclining to yellow; also yellow and brown. Streak greyish-white. Transparent . . . translucent.

Brittle. Hardness =4·0 . . . 4·5. Specific gravity = { 3·001, clove brown; 3·112, pale yellow } variety.

Compound Varieties. Massive: composition granular, individuals strongly coherent; face of composition uneven and rough.

1. Before the blow-pipe, and also from long exposure to the weather, it turns brownish-black.

2. *Analysis.*

By BROOKE.

Carbonate of iron and carbonate of magnesia, in the ratio of 1·315 of the former to 8·685 of the latter.

3. The varieties of the present species have often been found accompanying those of Dolomite; it also occurs in chloritic steatite.

4. It occurs at various places in Salzburg, Tyrol and Switzerland, also in Unst, one of the Shetland Isles. In the U. S. at Marlborough, (Vt.) in steatite; at Middlefield, (Mass.) and generally, in most of the soapstone quarries of New England.

APPENDIX TO RHOMB SPAR.

1. *Hystatic Carbon-Spar.* BREITHAUPT.

P on P = 107° 28′ 20″.

Cleavage, very perfect parallel with the primary form.

Hardness = 5·5 . . . 5·75 (scale of BREITHAUPT.) Sp. gr. = 3·040 . . . 3·089.

It is not believed to be a very rare species. Localities quoted, are the Hartz, Erbendorf in the Fichtelgebirge.

RIONITE. Selenious Malacone-Blende.

Primary form. Unknown. Massive: composition granular.

Color cochineal-red, to lead-grey. Streak of the lead-grey variety, blackish.

Sp. gr. = 5·5 . . . 5·6.

1. Under the blow-pipe, it burns with a beautiful, violet-colored flame, attended by much smoke, and the peculiar odor of selenium.

2. *Analysis.*

By DEL RIO.

The grey colored variety.

Selenium	49·00
Zinc	24·00
Mercury	19·00
Sulphur	1·50

which, with the addition of 6 p. c. of lime mechanically intermingled,

will amount to 99·5. It is, therefore, a bi-seleniuret of zinc united to a proto-sulphuret of mercury; the latter giving the grey color to the mineral. The red mineral is regarded as a bi-seleniuret of zinc, the mercury being in the state of a bi-sulphuret, which communicates the red color.

3. It is found at Calebras, near the mining district of El Doctor, in limestone, overlying the red sandstone, and is accompanied by Native Quicksilver.

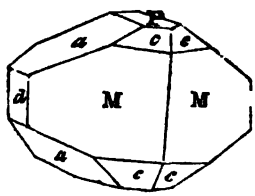
4. A fuller examination of the red and grey varieties, may show that they form distinct species.

Roselite.

*Primary form. Right rhombic prism. M on M = 132° 48′.

Secondary form.

Fig. 384.



a on *a* over *d* = 45° 0′

Cleavage perfect parallel to *d*. Surface M rough and hollowed out in the middle.

Lustre vitreous. Color deep rose-red. Streak white. Translucent.

Hardness = 3·0.

1. Before the blow-pipe, it gives off water and becomes black. It imparts a blue color to borax and salt of phosphorus; and is entirely soluble in muriatic acid. According to Children, it contains water, oxide of cobalt, lime, arsenic acid and magnesia.

2. It occurs at Schneeberg in Saxony, disposed on Quartz, and was formerly considered as a variety of Cobalt-Bloom.

3. It is nearly related to Pharmacolite.

Rubellan.

In six-sided prisms, whose angles are not known.

Cleavage perfect in one direction.

Rutile.

Color reddish-brown.

Hardness rather below 3.0. Sp. gr. =2·7.

1. In the flame of a candle, it exfoliates.

2. *Analysis.*

By KLAPROTH.

Silica	45·00
Oxide of iron	20·00
Alumina	10·00
Magnesia	10·00
Potash and Soda	10·00
Volatile matter	5·00

3. It is found with Mica and Pyroxene, at Schima in the Mittelgebirge, in Bohemia.

4. It appears to be a Mica which has become altered by heat.

RUBELLITE. (See *Tourmaline.*)

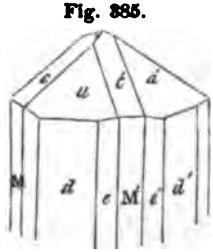
RUBINGLIMMER. (See *Limonite.*)

RUTILE. Peritomous Eruthrone-Ore.

Primary form. Right square prism.

Secondary form.

Fig. 385.



M on *d* - - -	135° 5′	PHILLIPS.
M on *e* - - -	161 40	"
M on *c* - - -	122 45	"
a on *a* - - -	123 15	"
a on *c* - - -	151 42	"
a on *d* - - -	123 15	"
e on *d* - - -	153 33	"
a on *a* over summit -	90 00	"
c on *c* " " -	109 47	"

Rutile.

Cleavage parallel with M perfect, with *d* interrupted. Fracture conchoidal, uneven. Surface, *a* and *c*, either smooth or rough, but both of the same quality; *d*, *e* and M vertically streaked.

Lustre metallic-adamantine. Color reddish brown, passing into red, sometimes yellowish. Streak very pale-brown. Translucent... opake, sometimes in a strong light, transparent.

Hardness =6·0...6·5. Sp. gr. =4·249.

Compound Varieties. Twin-crystals very frequent, axis of revolution perpendicular, face of composition parallel to face *a*. The composition produces geniculated groups, and is often repeated in several geniculations, as in fig. 387.

Fig. 386.

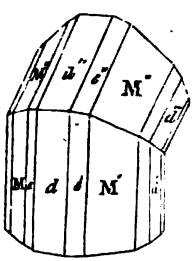
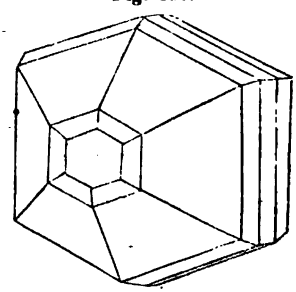


Fig. 387.



Thin and long individuals, produce after this law, a reticulated composition. Massive, composition granular, the individuals being of various sizes and strongly connected.

1. Alone before the blow-pipe, it is infusible, but gives with borax in the reducing flame a yellow glass, which assumes an amethyst-color, when farther reduced.

2. *Analysis.*

If pure, it is entirely composed of oxide of titanium, which according to Rose, consists of metal 66·05, and of oxygen 33·95.

3. It occurs, generally, in imbedded crystals, either in masses of Quartz engaged in gneiss or mica-slate, or in Feldspar in chlorite-slate. It is sometimes found massive in metalliferous veins, and is often enclosed in crystals of Quartz: besides, it occurs in the shape of pebbles in some gold stream-works.

4. Imbedded crystals in Quartz have been found at Rosenau in Hungary, Teinach on the Bacher in Stiria, and at various places along the chain of the Alps; also at Crianlarich in Perthshire and other places in Scotland. Very perfect crystals occur in the Saualpe, and massive varieties at Arendal in Norway. Switzerland and Savoy afford several localities. Pebbles have been found at Ohlapian in Transylvania which on account of their dark color, have been called Nigrine. At St. Yrieix in France, and in the province of Guadalaxara in Spain, the well known twin-crystals occur, often of very considerable dimensions. Finely crystallized individuals are brought from St. Gothard, and beautiful capillary crystals engaged in transparent Quartz, from Brazil.

The locality affording Rutile in the greatest quantity in the United States, is a very extensive ledge of chlorite-slate at Windsor, (Mass.) The crystals of Rutile are here thickly disseminated through narrow veins of Feldspar traversing this rock, and also occur in seams in the rock itself. Large compound crystals of a dark color, occur at Monroe and Huntington, (Conn.) rarely in the form of fig. 387. The mica-slate of Hampshire, Berkshire and Franklin counties, (Mass.) affords this species, but no where, in any considerable quantity. It is found in small brilliant crystals in white limestone with Spinel, Serpentine, Talc, Mica, &c. at Amity, (N. Y.) and with blue Corundum, Tourmaline and Spinel in the same rock at Newton, (N. J.) also in loose crystals in North Carolina and Virginia. It is on the whole, one of the most widely diffused of the scarce metals, existing in small quantity at numerous localities, but no where in the United States, excepting Windsor, in abundance.

SAHLITE. (See *Pyroxene*.)

SAL-AMMONIAC. Octahedral Ammoniac-Salt. MOHS.

Primary form. Regular octahedron.
Secondary forms. Cube. Trapezohedron.

Sal-Ammoniac.

Cleavage, parallel with the primary faces. Fracture conchoidal. Surface smooth.

Lustre vitreous. Color generally white, often inclining to yellow or grey. Sometimes it is stained green, yellow, or black. Transparent . . . translucent.

Very sectile. Hardness = 1·5 . . . 2·0. Sp. gr. = 1·528. Taste acute and pungent.

Compound Varieties. Stalactitic, botryoidal, globular, reniform shapes, also in crusts; composition columnar. Massive, composition impalpable. Fracture conchoidal. Sometimes in a state of mealy efflorescence.

1. It is perfectly volatile at a high temperature, dissolves readily in water, but does not attract water from the atmosphere. It emits a pungent smell of ammonia, if brought into contact with moistened quicklime.

2. *Analysis.*

By KLAPROTH.

From Mt. Vesuvius.

Muriate of ammonia	99·5
Muriate of soda	0·5

3. It occurs in fissures in the immediate vicinity of active volcanoes; and is a product of sublimation. It is also found near burning coal seams.

4. The best known localities, are Mount Etna and Vesuvius, the Solfataras, the Lipari islands, England, (particularly the neighborhood of New Castle) Scotland, Iceland, the vicinity of Liège, the Bucharian Tartary, &c.

This salt though much employed in the arts of dyeing, and in medicine, is of very little importance, as found in nature, on account of its scarcity.

SAPHIRINE.

Massive; cleavable.

Lustre vitreous. Color sapphire-blue, with shades of green and grey. Translucent. Streak white.

Hardness, scratches Quartz. Sp. gr. = 3·42.

Sassolin.

1. Before the blow-pipe, alone and with borax, it is infusible.

2. *Analysis.*

By STROMEYER.

Alumina	63·1
Silica	14·5
Magnesia	16·8
Lime	0·3
Protoxide of iron	3·9
Protoxide of manganese	0·5
Water	0·5

3. It occurs at Fiskanaes in Greenland, in a mica-slate rock.

SAPPARE. (See *Kyanite.*)

SAPPARITE.

Crystals, right rectangular prisms. Cleavage perfect, parallel with their lateral planes. Cross-fracture, uneven, to splintery.

Lustre, chatoyant. Color blue, very intense. Transparent.

Hardness, not sufficient to scratch glass.

Powder of a clear greyish-white color.

1. It comes from Pegu or Ceylòn, and is found engaged in a druse of Spinel.

SARCOLITE. (See *Analcime.*)

SASSOLIN. Prismatic Boracic-Acid. MOHS.

Loose scaly particles, crystalline grains, (probably six-sided tables) sometimes aggregated in the form of crusts.

Lustre pearly. Color greyish and yellowish-white. Streak white. Feebly translucent.

Sp. gr. = 1·480. Taste acidulous, afterwards bitter and cooling, lastly sweetish.

1. It is fusible in the flame of a candle, yielding a glassy globule, which acquires resinous electricity by friction, even without being isolated.

2. *Analysis.*

By BERZELIUS.

Borax	25·83
Oxygen	74·17

3. It occurs in a state of perfect purity, or only mixed with a little Sulphur, at the island of Volcano one of the Lipari group. It is also deposited from hot springs near Sasso, and from the *lagoni* of Tuscany.

4. It is extensively employed in the manufacture of borax.

SAUSSURITE. Dusclaone Petaline-Spar.

Primary form, unknown.

Cleavage, affords two faces meeting at angles of 124° nearly, pretty distinct. Traces parallel to the short diagonal of that prism. Fracture uneven, splintery. Massive: composition granular... impalpable, strongly coherent.

Lustre pearly, inclining to vitreous upon the faces of cleavage; resinous in compound varieties, particularly when cut and polished. Color white, passing into mountain green, greenish-grey and ash-grey. Streak white.

Brittle, very difficultly frangible. Hardness = 5·5. Sp. gr. = 3·256 of a granular variety from Piedmont, 3·342 of a compact variety from the Pays de Vaud.

1. Before the blow-pipe, it melts with difficulty into a white glass.

2. *Analysis.*

	By Saussure.		By Klaproth.
Silica	49·00		44·00
Alumina	24·00		30·00
Lime	10·00		4·00
Magnesia	3·75	Potash	0·25
Oxide of iron	6·50		12·50
Oxide of manganese	0·00		0·05
Soda	5·50		6·00
Loss	0·75		3·20

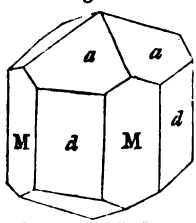
3. It is found in primitive mountains, and constitutes with Hornblende and Augite, the rocks called gabbro and euphotide. It occurs ni large masses upon Monte Rosa, and in its neighborhood; in Corsica; in the Bacher mountain in Lower Stiria, in Baryeuth, &c. In the United States at Canaan, (Conn.), it forms a mountain of some miles in extent.

SCAPOLITE. Pyramidal Petaline-Spar.

Primary form. Right square prism.

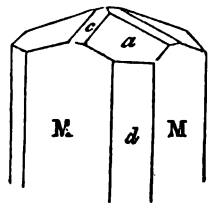
Secondary forms.

Fig. 388.



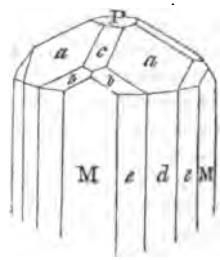
Governeur, St. Lawrence co., (N. Y.)

Fig. 389.



Pargas, Finland.

Fig. 390.



Vesuvius.

Fig. 388. *d* on *a* = 122° 20′. M on *d* = 135°. M on *a* = 112° 30′.—Fig. 390. *a* on *b* = 151° 31′. M on *b* = 140° 18′. *a* on *a* = 136° 22′. M on *e* = 153° 24′. *d* on *e* = 161° 35′.

Cleavage, parallel with M and *d* distinct, but interrupted; traces of P, generally a small conchoidal fracture in this last direction. Fracture imperfectly conchoidal, uneven. Surface of the prisms longitudinally streaked, but generally of nearly the same physical quality.

Lustre vitreous, inclining to resinous upon the cleavage and fracture, parallel with the bases; inclining to pearly upon M and *d*. Color various shades of white, grey, blue, green and red. Streak greyish white. Transparent... translucent on the edges.

Brittle. Hardness = 5·0 ... 5·5. Sp. gr. = 2·612, Meionite; = 2·726, white crystallized Scapolite from Finland.

Scapolite.

Compound Varieties. Massive: composition granular, of various sizes of individuals, sometimes elongated in one direction, or wedge shaped, and passing into columnar, or fibrous; generally strongly coherent.

1. The varieties of the present species have been treated of as constituting several distinct species. *Meionite* contains the purest and most transparent varieties of the species, of a white color. *Scapolite* consists of the translucent crystals and massive varieties, which are tinged green, black and red. *Wernerite* occurs in crystals of the form of fig. 389, which possess a greyish, or greenish grey, color. *Nuttallite* scarcely differs from Wernerite except in possessing a tinge of blue with the grey, and a feeble chatoyément. *Dypire* differs from Scapolite chiefly in its reddish white color, and thin columnar composition in massive varieties.

2. In a strong heat of the blow-pipe, Scapolite melts into a vesicular glass, and intumesces considerably; it then assumes the appearance of ice, and does not melt any longer. It is dissolved by borax with effervescence, melting into a clear globule.

3. *Analysis.*

Analysts.	Varieties.	Alumina.	Silica.	Potash & Soda.	Lime.	Protox. of iron.	Water.
John.	Wernerite.	30·000	50·250	2·000 potash	10·450	3·000	2·85
Laugier.	Scapolite.	33·000	45·000	2·000	17·600	1·000	0.00
Nordenskiold.	do. fr. Pargas.	35·430	43·830	0·000	18·960	0·000	1·03
Stromeyer.	Meionite.	32·726	40·530	1·812	24·245	0·182	0·00
Gmelin.	Meionite.	30·600	40·800	2·400	22·100	1·000	0·00
Thomson.	Nuttallite.	37·808	25·104	7·305 potash	18·336	1·500	0·00

4. Meionite is met with among the minerals ejected by volcanoes. The varieties of Scapolite occur in primitive rocks, as in the beds of Magnetic Iron in Sweden and Norway, and are generally accompanied by Pyroxene and Hornblende; also in beds of white limestone, associated with the above minerals, and in addition with Sphene and Petalite.

5. Scapolite is found at Arendal in Norway and in Wermeland in Sweden; also in large and beautiful crystals in the parish of Pargas, Finland, at Akudlek in Greenland, and some varieties near Chursdorf in Saxony. Dypire is found at Mauléon in the Western Pyrenees. Meionite occurs at Mt. Vesuvius.

Numerous localities of Scapolite are found in the United States. Beautiful crystals of the form of fig. 388, are found at Governeur, (N. Y) disseminated through a coarsely granular Calcareous Spar. Large crystals of a white variety rarely terminated with regularity, occur penetrating Quartz, which itself forms veins in white limestone at Bolton and Boxborough, (Mass.) Nuttallite is found also at Bolton in implanted crystals, rarely surmounted by four-sided pyramids. A purple variety exists at the same place, forming considerable masses, made up of large columnar individuals. Compact varieties occur at Boxborough and Westfield, (Mass.) A fibrous one is found at Monroe, (Connecticut.) Crystallized specimens are afforded by the white limestone of Amity, (N. Y.)

SCARBROITE.

Massive: composition impalpable. Fracture conchoidal.
Dull. Color white.
Very fragile. Sp. gr. =1·485.

1. It absorbs water without becoming more transparent.

2. *Analysis.*

Silica	10·50	7·90
Alumina	42·50	42·75
Oxide of iron	0·25	0·80
Water	46·75	48·55

3. It is found in little veins in greywacke in the great hill of Scarborough, England.

4. It is probably a mere mechanical aggregate, similar to clays in general.

SCHAALSTEIN. (See *Tabular Spar.*)

SCHEELETINE. Tungstic Lead-Baryte.

Primary form. Octahedron with a square base. P on P over the base = 131° 29′ 33″.

Secondary form, the primary, having the edges of the base and the pyramidal edges truncated, together with the

replacement of the angles at the summit, by four planes, resting on the primary planes.

Cleavage, parallel with the primary faces, indistinct.

Lustre resinous. Color green, grey, brown and red. Streak white.

Hardness =2·75 . . . 3·0. Sp. gr.=7·904 . . . 8·088.

1. It is fusible before the blow-pipe, yielding oxide of lead upon the charcoal. With soda, it affords globules of metallic lead.

2. *Analysis.*

Tungstic acid	52·00
Oxide of lead	48·00

3. It is a very rare substance; and is found in minute crystals, in the tin mines of Zinwald, Bohemia.

SCHEEVERITE.

In crystalline grains.

Lustre pearly, and feebly shining. Color whitish.

Friable. Rather heavier than water.

1. By heating, it emits a feeble aromatic empyreuma. It melts, very readily, into a colorless liquid. The melted mineral, on cooling, crystallizes into four-sided, acicular crystals. It burns with flame, attended with feeble odor, and without leaving behind any residue.

2. *Analysis.*

Carbon	73·00
Hydrogen	24·00

3. It is found in loosely aggregated grains, forming nests in a bed of brown coal, at St. Galen in Switzerland.

SCHILLER-SPAR. Diatomous Schiller-Spar. MOHS.

Primary form. Doubly oblique prism?

Cleavage in two directions, one of them being highly perfect and easily obtained, while the other appears only in slight traces. Inclination between 135° and 145°. Fracture uneven, splintery.

Lustre, metallic pearly, eminently so upon the perfect faces of cleavage; indistinctly vitreous upon the other faces. Color olive-green and blackish green, inclining to pinchbeck-brown upon the perfect faces of cleavage. Streak greyish white, inclining a little to yellow. Translucent on the edges.

Rather sectile. Hardness = 3·5 . . . 4·0. Sp. gr. = 2·692.

Compound Varieties. Massive: composition granular, of various sizes of individuals. The individuals are often intermingled with Serpentine.

1. Exposed to a high degree of heat, it hardens into a porcelainous mass.

2. *Analysis.*

	By Heyer.	By Vauquelin.	By Drappier.
Silica	52·00	62·00	41·00
Magnesia	6·00	10·00	29·00
Alumina	23·33	13·00	3·00
Lime	7·00	0·00	1·00
Oxide of iron	17·50	13·00 and manganese.	14·00
Water	0·00	0·00	10·00

3. The varieties of Schiller-Spar occur imbedded in simple and compound crystalline masses in serpentine, with which they are mixed. The only locality in Europe, which can be quoted with certainty, is the Baste in the forest of Harzgeburg in the Hartz. It is found of a blackish color, with Serpentine and Kerolite, at Blandford, (Mass.)

Schorl. (See *Tourmaline.*)

Scolezite. (See *Mesotype.*)

SELENCUPRITE. Selencupreous Polypoione-Glance.

Massive: composition impalpable.

Lustre metallic. Color silver-white. Streak shining. Ductile?

1. Fusible before the blow-pipe into a grey globule, which is slightly malleable. It is decomposed by nitric acid, and the solution deposits metallic copper on a piece of clean iron.

2. *Analysis.*
By BERZELIUS.

Selenium	40·00
Copper	64·00

3. It occurs forming black coatings upon Calcareous Spar, or in minute seams traversing this substance, at the copper-mine of Skrickerum in Smoland.

SELENIURET OF COPPER. (See *Selencuprite.*)

SELENIURET OF LEAD. (See *Clausthalite.*)

SELENIURET OF PALLADIUM. (See *Selenpalladite.*)

SELENIURET OF SILVER AND COPPER. (See *Eukairite.*)

SELENIURET OF SULPHUR. (See *Sulpho-selenite.*)

SELENIURET OF ZINC AND MERCURY. (See *Rionite.*)

SELENPALLADITE.

Primary form. Regular hexagonal prism.
Cleavage, parallel with the base, perfect.
Lustre metallic. Color white to grey. Opake.
Brittle.

1. Heated in a glass tube, it gives a red ring of selenium. It is fusible into a brittle metallic globule, and dissolves with borax into a colorless glass. The roasted ore affords in nitro-muriatic acid a brown solution, from which some chloride of silver, and crystalline chloride of lead, is precipitated. The addition of cyanide of mercury, colors the solution, and throws down cyanide of palladium. According to ZINKEN, it consists of seleniuret of palladium, seleniuret of silver, and seleniuret of lead.

2. It is found with Native Gold and Clausthalite, at Zilkerode in the Hartz. It is likewise said to occur in the Russian platina-mines.

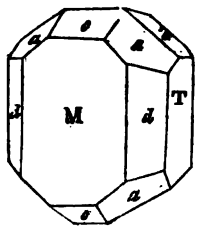
SERPENTINE. Prismatic Atelene-Picrosmine.

Primary form. Right rectangular prism.

Serpentine.

Secondary form.

Fig. 391.



o on *o*	-	-	-	-	128°	31′
d on *d*	-	-	-	-	97	33
a on *a′*	-	-	-	-	139	34
a on *a*	-	-	-	-	105	26
a on *d*	-	-	-	-	134	13

Cleavage. Traces of, parallel with M and *d*, apparent only in a strong light. Fracture flat conchoidal, splintery, uneven. Surface almost dull, very little glistening, but rather even.

Lustre resinous, indistinct, low degrees of intensity. Color dark blackish green and leek-green, seldom lighter shades of oil-green and siskin-green colors, none of them being bright: they pass into yellowish-grey. Streak white, acquires some lustre. Translucent... opake.

Sectile. Hardness=3·0. Sp. gr.=2·507, of a greenish black crystallized variety; =2·56, of an oil-green, translucent one.

Compound Varieties. Massive: composition granular, impalpable. Varieties of this kind present also, red, brown, black, yellow, and grey colors, in different veined, spotted and other delineations. The purer varieties sometimes possess an indistinctly slaty structure.

Serpentine.

1. Serpentine is divided into two subspecies, the *common* and *precious;* the latter embracing those varieties which possess handsome colors, and a tendency to conchoidal fracture; the former includes the duller colors and the slaty varieties.

2. It hardens on being exposed to fire, and melts only with great difficulty on the edges.

3. *Analysis.*

By JOHN.

Silica	42·50
Magnesia	38·63
Alumina	1·00
Lime	0·25
Oxide of iron	1·50
Oxide of manganese	0·62
Oxide of chrome	0·25
Water	15·20

4. Serpentine forms mountain masses and beds in primitive rocks, and frequently contains crystals, grains, or compound nodules of various other species. Precious Serpentine, in particular, is often mixed with white limestone.

5. The different varieties of Serpentine are met with in Saxony, Silesia, Austria, Hungary, Stiria, Italy, Corsica, Sweden, England, Scotland, and other foreign countries.

Crystallized varieties, of a blackish green color, sometimes of considerable dimensions, occur at Amity, (N. Y.) disseminated through limestone, along with black Spinel and Ilmenite; also at Byram, (N. J.) in the same rock with red Spinel. At the last place, the color of the Serpentine is oil-green. Serpentine, of a handsome green color, and conchoidal fracture, is found at Newburyport, (Mass.) and at Newport, (R. I.); of a very light green color, at Phillipstown, in the Highlands of New York. Extensive formations of Serpentine exist in the neighborhood of New-Fane, (Vt.) and of Middlefield, (Mass.)

SIDERITE. (See *Quartz.*)

SIDEROSCHISOLITE. (See *Limonite.*)

SILICATE OF IRON.

SILICEOUS OXIDE OF MANGANESE. (See *Manganese Spar.*)

SILICO-CALCAREOUS OXIDE OF TITANIUM. (See *Sphene.*)

SILLIMANITE. (See *Bucholzite.*)

SILVER-BISMUTH.

In acicular and capillary crystals. Massive; composition impalpable. Fracture uneven.

Lustre metallic. Color, light lead-grey.

1. Before the blow-pipe it melts with ease, and covers the charcoal with oxide of lead and bismuth, leaving a globule of silver behind.

2. *Analysis.*

By KLAPROTH.

Lead	33·00
Bismuth	27·00
Silver	15·00
Iron	4·30
Copper	0·90
Sulphur	16·30

3. It occurs at Schlapbach in Baden.

SILVER-BLACK.

Massive; composition impalpable, in crusts, pulverulent.

Color bluish-black, sometimes blackish lead-grey.

1. It melts easily before the blow-pipe into a slaggy mass, leaving a metallic button on farther heat.

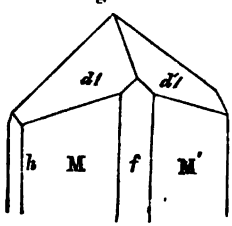
2. It is found in the silver mines of Saxony, Hungary, in Siberia, and in South America.

SKORODITE. Prismatic Malachite-Haloide. PARTSCH.

Primary form. Right rhombic prism. M on M = 120′.

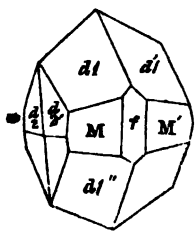
Secondary forms.

Fig. 392.



Cornwall.

Fig. 393.

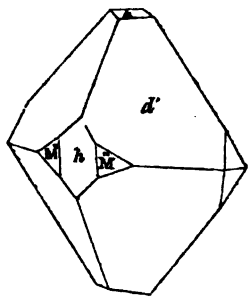


Saxony.

Skorodite.

M on *d*1 -	141° 26′	M on *f* -	103° 5′
*d*1 on *d*1′ -	103 00		

Fig. 394.



Carinthia.

Cleavage, imperfect parallel to M and *f*. Fracture uneven. Surface, *d* uneven and irregularly streaked parallel to its own edges. M and *f* streaked vertically. The rest of the faces commonly very smooth and even.

Lustre vitreous, inclining to adamantine on the surface, and to resinous in the interior. Color, principally leek-green, which passes almost into white; also bluish-white, olive-green and liver-brown. Streak white. Semi-transparent . . . translucent on the edges.

Rather brittle. Hardness=3·5 . . . 4·0. Sp. gr.=3·162.

1. Before the blow-pipe, it emits an arsenical odor, and melts into a reddish-brown scoria, which acts upon the magnet, if it has been heated long enough to drive off all the arsenic.

2. *Analysis.*

	By Chenevix. from Cornwall.		By Ficinus. from Saxony.
Oxide of copper	22·5		00·00
Oxide of iron	27·5	with magnesia, lime & manganese.	47·80
Arsenic acid	33·5		31·40
Water	12·0		18·00
Silica	3·0		0·00
Sulphuric acid	0·0		1·54

3. It occurs in the primitive mountains of Schwarzenberg in Saxony, with Arsenical Pyrites; at Löling near Hüttenberg in Carinthia, with Leucopyrite. Beautiful specimens have been brought from Brazil.* It occurs also in several of the Cornish mines, where it has commonly been called Martial Arseniate of Copper.

SMALTINE. Octahedral Eruthleucone-Pyrites.

Primary form. Regular octahedron.

Secondary forms.

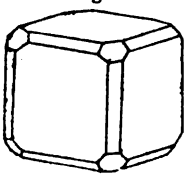
1.
Primary, with the angles truncated.
Dobschau, Saxony.

2.
Cube.
Schladming, Stiria.

3.
Cube, with edges truncated.
Schneeberg, Saxony.

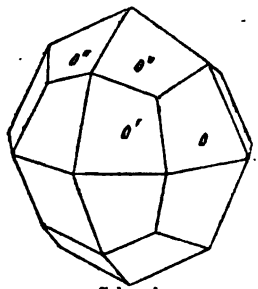
4.
Rhombic dodecahedron.

5. Fig. 395.



Schneeberg.

6. Fig. 396.



Schneeberg.

Cleavage, traces in the direction of the primary faces, as well as those parallel with the cube and dodecahedron; the first, a little the most distinct. Fracture uneven. Surface

* A considerable quantity of this rare mineral was a few years since brought from the western coast of South America to Baltimore, to be smelted, from whence it was re-shipped to England, before its true nature was detected by the mineralogists of this country.

generally pretty smooth; the faces of the cube often curved. Subject to tarnish.

Lustre metallic. Color tin-white, inclining to steel-grey. Streak greyish-black.

Brittle. Hardness = 5·5. Sp. gr. = 6·466, a cleavable variety.

Compound Varieties. Reticulated and other imitative shapes; the individuals of them being often discernible. Massive: composition granular, individuals of various sizes.

1. Heated in an open tube, it emits a good deal of arsenious acid. On charcoal, before the blow-pipe, it yields a strong smell of arsenic, and melts into a greyish-black pearl, which is magnetic. With borax and salt of phosphorus, it produces a sapphire-blue glass. In powder, with concentrated nitric acid, it immediately developes red fumes, attended with effervescence and the extrication of heat.

2. *Analysis.*

	By Stromeyer. fr. Riegelsdorf.	By John. fr. Schneeberg.	By Laugier. fr. Bieber.
Arsenic	74·22	65·75	68·50
Cobalt	20·31	28 00	9·60
Iron	3·42 (with mang.)	6·25	9·70
Copper	0·16	0·00 silica	1·00
Sulphur	0·89	0·00	7·00

3. It is principally met with in veins, traversing rocks of various ages, more rarely in beds. It is accompanied by ores of silver, or by ores of copper. In beds, it is attended by Mispickel and Copper-Nickel.

4. It is found in veins, traversing primitive rocks, at Schneeberg and Annaberg in Saxony; also at Freiberg and Marienberg; likewise at Joachimsthal in Bohemia, and in veins in killas, at Wheal Sparnon in Cornwall. The veins of the counties of Sayn and Siegen, which contain it, are included in greywacke; and those of Thuringia and Mansfeld, and of Riechelsdorf in Hessia, in cupriferous shale. It occurs in beds at Schladming in Stiria, at Orawitza in the Bannat, and at Dobschau in Hungary. But a single locality of Smaltine is known to exist in the U. States, which is at Chatham, (Conn.), where it occurs in veins traversing gneiss, accompanied by Mispickel and Copper-Nickel.

5. It is a valuable ore for the preparation of blue enamel-colors, and particularly for smalt.

SMARAGDITE. (See *Pyroxene.*)

SOAPSTONE. (See *Talc.*)

SODA-ALUM. (See *Solfatarite.*)

SODALITE. Dodecahedral Kouphone-Spar. MOHS.

Primary form. Rhombic dodecahedron.

Secondary forms.

1.	2.
Primary form, with the acute-angles truncated. Lake Laach.	Cube, with edges truncated. Greenland.

Grains.

Cleavage, parallel with the primary, with different degrees of perfection. Fracture conchoidal, uneven. Surface even, though sometimes rough.

Lustre vitreous. Color greyish-black, passing into ash-grey and brown, sometimes a whitish play of light parallel to the planes of the cube, white passing to green and blue, the latter often deep azure-blue. Streak paler than the color. Transparent . . . translucent on the edges.

Brittle. Hardness = 5·5 . . . 6·0. Sp. gr. = 2·2 . . . 2·3.

Compound Varieties. Massive: composition granular, individuals strongly connected; fracture uneven.

1. The present species consists of what was once believed to constitute four different ones: 1. *Lapis-lazuli*, the deep azure blue massive varieties, commonly found along with massive Iron Pyrites; 2. *Hauyne*, crystallized in dodecahedra, and in grains of a bright blue color; 3. *Sodalite*, in white transparent crystals; 4. *Spinellane*, in ash-grey and brown crystals.

2. Before the blow-pipe, Lapis-lazuli melts with difficulty into a glassy globule, which is first of a bluish tinge, but soon becomes white. The compact varieties melt more easily, and with a slight effervescence. It is dissolved with considerable effervescence by borax, and forms with it a clear globule. If previously burnt and reduced to powder, it loses its color, and forms a jelly with acids. Haüyne melts into a vesicular glass, and loses its color. It effervesces if melted with glass of borax, and forms a transparent globule, which becomes yellow on cooling. Sodalite, before the blow-pipe, melts with intumescence and the developement of air bubbles, into a colorless, glassy globule: with borax, it melts with difficulty, and only when added in small proportion. Spinellane is infusible, whether alone, or with additions.

3. *Analysis.*

Analysts and varieties.	*Silica.*	*Magnesia.*	*Alumina.*	*Lime.*	*Potash & soda.*	*Oxide of iron.*	*Sulphuric acid.*
GMELIN. Lapis-lazuli.	49·00	2·00	11·00	16·00	8·00	4·00	2·00
ECKEBERG. Sodalite.	36·00	0·00	32·00	0·00	25·00	0·15	6·75 mur. acid
THOMSON. Sodalite.	38·52	0·00	27·48	2·10	25·50	1·00	3·00 mur. acid
GMELIN. Hauyne.	35·48	0·00	18·87	12·00	15·45 potash.	1·16	12·39
KLAPROTH. Spinellane.	43·00	1·00 sulphur	29·50	1·50	19·09 soda.	2·00	0·00

4. Lapis-lazuli has been brought from Lesser Bucharia, Thibet and China. It has lately been found at Lake Baikal in Siberia, in veins with Iron Pyrites, Feldspar and Garnet. Haüyne occurs at Albano and Frescati near Rome, among the products of Vesuvius; also in the neighborhood of Puy de Dome, on the Lake of Laach, in the quarries of Niedermeunich, and in several other places near Andernach, partly imbedded in pumice. Sodalite is found in West Greenland, in a bed in mica-slate, from six to twelve feet thick; and is accompanied by several species of Augite-Spar and Feldspar, as well as by Zircon and Eudyalite. It occurs likewise among the minerals ejected by Mount Vesuvius. Spinellane is found on the shores of Lake Laach, with Feldspar, Hornblende and Magnetic Iron-Ore.

5. The variety Lapis-lazuli is cut into various ornamental articles, as ring stones, snuff boxes, &c. It is manufactured into a very costly pigment, called Ultramarine.

SODA-NITRE. Rhombohedral Natron-Salt.

Primary form. Rhomboid. P on P = 106° 33′.

Cleavage, perfect parallel with the primary faces. Fracture conchoidal, almost imperceptible. Surface smooth.

Lustre vitreous. Color white. Streak white. Transparent.

Rather sectile. Hardness = 1·5 . . . 2·0. Sp. gr. = 2·0964. Taste cooling.

Compound Varieties. In efflorescences.

1. It melts and deflagrates with a yellow light upon red-hot charcoal, but not so violently as Nitre. It is soluble in three times its weight of water, at 60° F. If rubbed in an isolated state, it acquires a very strong negative electricity.

2. *Analysis.*

By Berzelius.

Nitric acid - - - - - - - -	54·97
Soda - - - - - - - -	45·03

It contains a little sulphate of potash.

3. It is found in immense quantity in the district of Tarapaca in Peru, near the frontiers of Chili, three days' journey from La Conception, a port of Chili. It also comes from Iquiqui, a port in the south of Peru. In these countries, it forms a bed many feet thick, which in some places appears on the surface, occupying an extent of more than forty leagues. It is frequently mixed with clay and sand.

4. Very large quantities of this salt, purified by solution and crystallization, are carried into Europe, and imported into the United States.

SOLFATARITE. Prismatic Alum-Salt.

Massive; composition columnar, individuals thin, straight and parallel. Cleavage in one direction, perfect.

Lustre vitreous, to pearly. Color white; transparent to translucent.

Hardness=2·0 . . . 2·5. Sp. gr.=1·88. Taste sweetish astringent.

1. It is more soluble in water than alum.

Solfatarite.

2. *Analysis.*

	By Thomson. from Mendoza, S.A.	By Boussingault. from Rio-Saldana.	By Hartwall. from Milo.	By Rose. from Copiapo.
Sulphuric acid	37·700	36·40	40·31	36·97
Alumina	12·000	16·00	14·98	14·62
Water	41·900	46·60	40·94	44·64
Soda	7·960	0·00	1·12	0·00
Potash	0·000	0·00	0·26	0·00
Silica	0·022	0·00	1·13	1·37
Lime	2·256	0·02	0·00	0·00
Peroxide of iron	0·207	0·04	traces.	2·58
Magnesia	0·796	0·00	0·85	0·14
Protox. manganese		0·00	0·00	0·00
Muriatic acid	0·100	0·00	0·400	0·00

3. This substance is found in the *solfataras* of Guadaloupe, the Lipari islands, at Milo and other islands in the Grecian archipelago; at Copiapo, a province of Coquimbo in Chili, where it forms with White Copperas a large mass; and at Mendoza near the foot of the Andes.

Sommervillite. (See *Idocrase.*)

Sommite. (See *Nepheline.*)

Sordawallite.

Massive: composition impalpable; no trace of cleavage. Fracture conchoidal.

Lustre vitreous, inclining to semi-metallic. Color greenish black or greyish black. Opake.

Brittle. Hardness, equal to that of glass. Sp. gr. = 2·53.

1. It becomes reddish by exposure to the atmosphere. Before the blow-pipe, it forms with difficulty a blackish globule. With a small quantity of soda, it yields a blackish green globule; with a larger quantity, a rough slaggy mass is produced. Borax dissolves it into a green glass. It is partly soluble in muriatic acid.

2. *Analysis.*

By Nordenskiold.

Silica	49·40
Alumina	13·80
Peroxide of iron	18·17
Magnesia	10·67
Phosphoric acid	2·26
Water	4·26

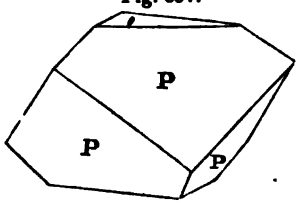
3. It occurs near the town of Sordawala in Finland, in layers from half an inch to one inch in thickness, in a primitive rock.

SPATHIC IRON. Brachytypous Parachrose-Baryte. MOHS.

Primary form. Rhomboid. P on P=107°.

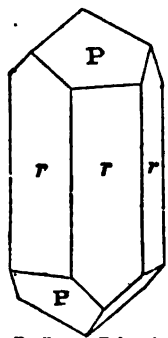
Secondary forms.

Fig. 397.



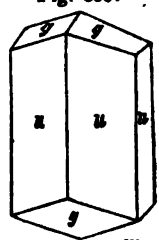
Przibram, Bohemia.

Fig. 398.



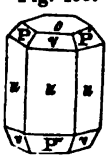
Przibram, Bohemia.

Fig. 399.



Wheal Maudlin, Cornwall.

Fig. 400.



Cornwall.

Fig. 401.

Cornwall.

Fig. 402.

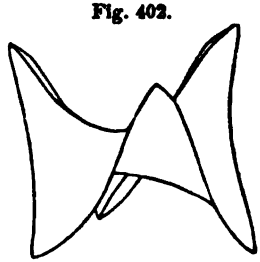


Fig. 397. Primary form, with the summits truncated.—Fig. 398. Primary form, with the lateral angles truncated.—Fig. 399. Similar to Fig. 398, but having the upper edges of the rhomboid so deeply truncated, as to give rise

to new planes *g*. *g* on *g* = 136° 34′.—Fig. 400. *o* on *v* =155′. *v* on *v*=67° 20′.

Cleavage, perfect parallel with P; rarely, traces of *g*. Fracture imperfectly conchoidal.

Surface, *o* generally rough; P often rounded, which terminates in the saddle shaped lens. Fig. 402. *o* streaked parallel to the edges of combination with P; *u* rough. The common lens is produced by continued striæ between *g* and P.

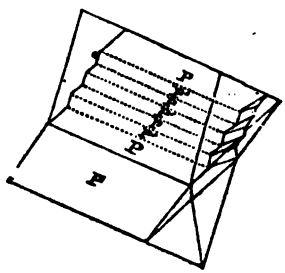
Lustre vitreous, inclining to pearly. Color various shades of yellowish grey, passing into ash-grey and greenish grey; also into several kinds of yellow, white and red. Streak white. Translucent, in different degrees.

Brittle. Hardness=3·5 . . . 4·5. Sp. gr.=3·829.

Compound Varieties. Striæ upon the faces of P in the direction of the horizontal diagonals; and faces of composition parallel to *g* prove the existence of a regular composition. Botryoidal and globular shapes: composition columnar, surface drusy. Massive: composition granular, passing into impalpable.

1. The massive varieties of the present species are often regularly compound in the direction of the faces of *g*, as in the annexed figure.

Fig. 403.



Spathic Iron.

It is sometimes possible to obtain from them by fracture the form of *g*, bounded on all sides by faces of composition, without presenting a single real face of cleavage. There is no distinct cleavage parallel to the face of *g*. The saddle shape lenses are in part composed of several individuals nearly in parallel position, but the axes of which are slightly diverging.

2. Before the blow-pipe, it becomes black, and acts upon the magnetic needle, but does not melt. It colors glass of borax green. It is soluble with difficulty, and effervesces but little in nitric acid, particularly if not reduced to powder. On being exposed to the air, it is gradually decomposed; first the color of the surface becomes brown or black; afterwards the streak is changed into red or brown, hardness and sp. gr. are diminished, and even the chemical constitution is altered, the whole being converted into hydrate of iron.

3. *Analysis.*

By Klaproth.

	A botryoidal variety.	A cleavable variety.
Protoxide of iron	63·75	57·50
Carbonic acid	34·00	36·00
Oxide of manganese	0·75	3·30
Lime	0·00	1·25
Magnesia	0·52	0·00

4. Spathic Iron is frequently found along with compound varieties of Calcareous Spar in beds in gneiss, mica slate, clay-slate and newer-rocks; sometimes with Limonite and Specular Iron, Heavy Spar, and other species. It likewise occurs in metalliferous veins, accompanied by Galena, Fahlerz, Iron Pyrites, &c. More rarely, it occurs in the cavities of trap rocks.

5. The beds in which the varieties of the present species are found in immense quantities in Stiria, Carinthia, and the bordering countries, form connected tracts, which extend along the chain of the Alps, on one side into Austria, and on the other into Salzburg. The celebrated Erzberg near Eisenerz, is situated in one of them. At Freiberg, it is found in silver veins. It is found with Tin-Ore, at Ehrenfreidersdorf in Saxony, Wheal Maudlin, St. Just, and other places in Cornwall. It is also found, in more or less considerable masses, in Bohemia, Bayreuth, Würtemberg, Switzerland, France, Spain, and many other countries.

A very considerable vein of Spathic Iron exists in the United States, at Roxbury, (Conn.) which traverses in a vein of Quartz, a mountain of

gneiss for the distance of a mile. A bed of it also exists at Plymouth, (Vt.) It is found in small quantity at Lane's mine in Monroe, (Conn.)

APPENDIX TO SPATHIC IRON.

i. *Kaminoxene Carbon-Spar.* BREITHAUPT.

P on P = 107°.

Cleavage, perfect parallel with P, traces parallel with *o*.

Hardness (scale of BREITHAUPT) = 5. Sp. gr. = 3·765.

1. It appears that 1 p. c. of oxide of manganese is essential to the present species. To it belongs the white Sparry-iron from Vorgtlande, from Bayreuth, and from Siegen in Prussia.

ii. *Olixone Carbon-Spar.* BREITHAUPT.

P on P = 107° 3′.

Cleavage, parallel with P perfect.

Hardness (scale of BREITHAUPT) = 5·0 . . . 5·25.

Sp. gr. = 3·7453, from Ehrenfriedersdorf.

Analysis.

By MAGNUS.

Carbonate of iron - - - - - -	59·99
Carbonate of manganese - - - - -	40·66

iii. *Allotropose Carbon-Spar.* BREITHAUPT.

P on P = 107° 11½′.

Cleavage, parallel with P perfect.

Hardness (scale of BREITHAUPT) = 5·25 . . . 5·50.

Sp. gr. = 2 992, from Hall in Tyrol.

= 3·001, a liver-brown variety.

Analysis.

By STROMEYER.

Carbonate of magnesia - - - -	89·70
Carbonate of iron - - - -	8·02
Carbonate of manganese - - - -	2·44

iv. *Mesitine Carbon-Spar.* BREITHAUPT.

P on P = 107° 14′.

Cleavage, parallel with P very perfect; traces parallel with *o*.

Color dark greyish and yellowish grey. Transparent and translucent.

Hardness (scale of BREITHAUPT) = 5·00.

Sp. gr. = { 3·350 / 3·368 } from Traversella, Piedmont.

1. Before the blow-pipe it decrepitates; in muriatic acid, and in nitric acid, a feeble effervescence takes place, but it is entirely soluble. It probably contains magnesia, lime, protoxide of iron, and oxide of manganese.

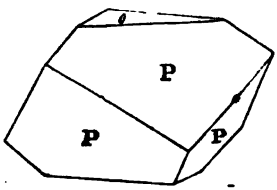
2. It occurs at Freiberg, as well as in Piedmont and the island of Elba.

SPECULAR IRON. Rhombohedral Iron-Ore. Mohs.

Primary form. Rhomboid. P on P = 85° 58′ ... 86° 10′.

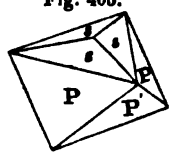
Secondary forms.

Fig. 404.



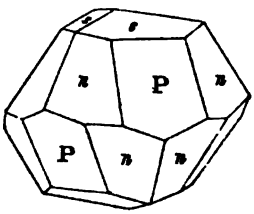
Vesuvius.

Fig. 405.



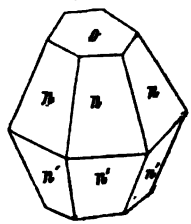
Elba.

Fig. 406.



Framont.

Fig. 407.



Elba.

Specular Iron.

Fig. 408.

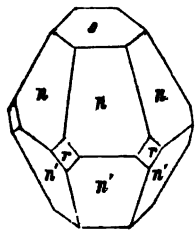
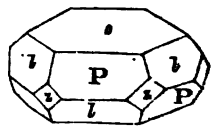
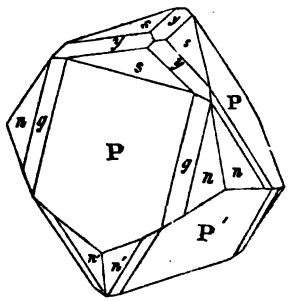


Fig. 409.



Framont.

Fig. 410.



Elba.

Fig. 404. Primary form with summits truncated. P on $o=122^\circ\ 40'$. (*basé*, Hauy.)—Fig. 205. Primary, with the summits replaced by three planes, which, if extended, would lead to an obtuse rhomboid. s on $s=142^\circ\ 56'$. (*birhomboidal*, Hauy.)—Fig. 406. The same with Fig. 405, but having the upper edges of the rhomboid bevelled by planes n. n on $n=128^\circ$. (*binoternaire*. Hauy.)—Fig. 407. n on $o=119^\circ\ 34'$. (*trapézien*. Hauy.)—Fig. 409. P on $b=113^\circ\ 32^\circ$. o on $z=90^\circ$. (*equivalent*, Hauy.)—Fig. 410. n on $y=138^\circ\ 53'$. P on $g=166^\circ\ 25'$. *equipollent*, Hauy.)

Specular Iron.

Cleavage, parallel with P and *o*. In some varieties scarcely any traces appear, while in others it seems to be perfect, which however, must in a great measure be attributed to composition. Fracture conchoidal, uneven. Surface, *s* is horizontally streaked, sometimes so deeply that it appears rounded; P is sometimes streaked parallel to the edges of combination with *n*; *y* is uneven, and often curved.

Lustre metallic. Color dark steel-grey, iron-black. Streak cherry-red, reddish brown. Surface frequently tarnished; generally with the exception of *o*, which may be useful in finding the true position of the crystals, when they become complicated. Opake; very thin laminæ are faintly translucent, and show a deep blood red color.

Brittle. Sometimes feeble action upon the magnetic needle. Hardness=5·5 . . . 6·5. Sp. gr.=5·251, a crystalline variety from Sweden.

Compound Varieties. Twin-crystals. 1. Axis of revolution perpendicular; face of composition parallel to *o*; the individuals are continued beyond the face of composition. (Altenberg, Saxony.) Sometimes two individuals in the same position are joined in a face of *n*, and terminate at this face. (Stromboli.) 2. Axis of revolution perpendicular, face of composition parallel to a face of P.

Globular, reniform, botryoidal, and stalactitic shapes: surface generally smooth, composition more or less thin columnar, sometimes even, impalpable; in this case the lustre becomes imperfectly metallic, and the color red; fracture of impalpable compound varieties, even, flat conchoidal, or uneven. Compound varieties often join in a second and third composition, which are curved lamellar and granular; the junction of granular masses produces frequently very

smooth faces, while the reniform surface of the curved lamellar compositions is rough, and obtained with more difficulty, by separating the particles, than the first. Massive: composion, 1. Columnar, generally imperfect, thick, and diverging from common centres. 2. Granular, and often impalpable; sometimes very distinct and easily separated; often, however, they are strongly coherent: if they are impalpable, their lustre decreases, their color becomes red, and the fracture even, uneven, or flat conchoidal. 3. Lamellar, joined in the face of *o*, thick and variously bent; sometimes, however, they are so thin, that they allow blood-red light to pass; if they are still thinner, their color becomes red altogether, and their lustre imperfectly metallic; the faces of composition are often irregularly streaked. When the cohesion among the particles is diminished, the lamellar varieties become scaly and glimmering, the granular ones earthy and dull. Pseudomorphoses in the shape of Calcareous Spar, Fluor, &c.

1. Owing to a want of attention to the simple and compound state of he contents of the present species, has arisen its subdivision into two species by the majority of mineralogists; viz. into *Specular Iron-Ore* and *Red Iron-Ore*. Specular Iron contains all the simple varieties, and those of the compound ones which have not lost their metallic appearance by the too small size of their component individuals. Those in thin lamellar compositions have been called *Micaceous Specular Iron*, while the rest form the *Common Specular Iron*. Those varieties which have lost their metallic appearance, are included within the *Red Iron-Ore*, divided into *Fibrous* Red Iron or *Red Hematite*, which occurs in reniform and other imitative shapes, and consists of columnar particles of composition; into *Compact* and *Ochrey* Red Iron, which are massive, and consist of impalpable, granular individuals, more or less firmly connected; and into *Scaly* Red Iron, or *Red Iron-Foam*, consisting of very small scaly particles, which in most cases are but slightly coherent. This variety is in immediate connexion with the micaceous

Specular Iron.

Specular Iron, between which and the crystallized Specular Iron there exists an uninterrupted transition. Among the varieties of *Clay Iron-Ore*, the following may be considered as an appendix to the present species, all of which are of a red color, but more or less impure, and mixed with earthy substances. Reddle possesses an earthy, coarse slaty fracture; it soils and writes, and may be used as a drawing material. *Jaspery Clay Iron-Ore*, has an even or large flat conchoidal fracture, and a hardness which is considerable, if compared with other minerals of a similar formation. *Columnar* and *Lenticular Clay Iron-Ore* are distinguished, the first by the columnar form, the latter by the flattish granular form of its particles of composition.

2. Specular Iron is infusible before the blow-pipe, but melts with borax, and forms a green or yellow glass, like pure oxide of iron. It is likewise soluble in heated muriatic acid.

3. *Analysis.*

Analysts.	Varieties and localities.	Ox. of iron.	Ox. mang.	Silica.	Lime.	Alumina.	Water.	Total.
Bucholz.	Micaceous Iron-Ore.	100·00	0·0	0·00	0·0	0·00	0·0	100·00
D'Aubisson.	Red Hematite. Framont.	90·00	trace.	2·00	1·0	0·00	3·0	96·00
"	" " "	94·00	trace.	2·00	trace.	0 00	2.0	98·00
Bucholz.	Compact Red Iron.	100·00	0·0	0·00	0·0	0·00	0·0	100·00
Lampadius.	Compact Red Iron.	65·40	2·7	20·70	0·0	9·3	0·0	98·10
Bucholz.	Red Iron-Foam.	100·00	0·0	0 00	0·0	0·0	0·0	100·00
Henry.	" " "	94·50	0.0	4·25	0 0	1·25	0·0	100·00

The clay iron-ores, being more or less mixed with earthy substances, vary in their contents, and several of their properties are dependent upon the nature of these admixtures. Thus lenticular clay iron-ore is very rich, while the columnar variety contains but little iron, and is produced from nodules of common clay, which have been converted by the influence of heat from burning coal seams, the one into columnar clay iron-ore, the other into porcelain Jasper.

4. It occurs most commonly in beds and veins in ancient rocks. Clay iron-ore forms either by itself beds in secondary mountains, or it is included in beds of clay in the shape of nodules or irregular masses. Specular Iron-Ore occurs in crystals among the rocks ejected by Vesuvius, and lining the cavities and fissures of lava, where it seems to be a product of sublimation. In beds, it is generally accompanied by other ores of iron, several species of earthy minerals, as Epidote, Hornblende and Augite, Calcareous Spar and Quartz.

5. The most beautiful crystals hitherto known, for size and form, are found in the island of Elba, along with Iron Pyrites and Quartz. Splendid geodes of crystals also come from Framont in Loraine, St. Gothard in Switzerland, and Dauphiny; at the last mentioned place, they occur in veins in primitive rocks. Other localities are, the vicinity of Vesuvius and the island of Stromboli, Norway, Sweden and Stiria. Micaceous Iron-Ore is very common in the beds of Spathic Iron, in Stiria and Carinthia. Red Iron-Ore is found in Saxony, Bohemia, the Hartz, the Fichtelgebürge, at Ulverstone in Lancashire, and other places in England, and in many other countries. Jasper clay iron-ore is almost entirely confined to Lower Austria; the columnar variety occurs in several localities of the north of Bohemia, in the countries of Elbogen and Leitmeritz; the lenticular Clay Iron-Ore forms a bed in the transition district of Central Bohemia, in the counties of Pilsen, Beraun, &c.

But few localities of crystallized Specular Iron are known in the U. States. What was believed to be Specular Iron, from Amity, (N. Y.), and which occurs along with Spinel in limestone and Serpentine, is Crichtonite. Druses of lenticular or micaceous crystals, are found at Fowler, St. Lawrence co. (N.Y.) The Micaceous Iron, in large masses, consisting of thin waved laminæ, themselves composed of the finest scales, occurs at Hawley, (Mass.) Red Hematite is found at Ticonderoga, upon Lake George; and Lenticular clay-Iron ore is abundant throughout the western part of New York. Pebbles of compact Red Iron-Ore are found throughout the hills in the vicinity of Marietta, (Ohio.)

6. Specular Iron is an ore of the highest importance, and yields a considerable proportion of the iron annually produced in the different quarters of the globe. Red Hematite, sometimes also, compact Red Iron-Ore, are used for polishing metals, and Reddle as a writing material.

SPHENE. Prismatic Eruthrone-Ore.

Primary form. Oblique rhombic prism. M on M = 133° 30′. P on M = 121° 50′.

Sphene.

Secondary forms.

Fig. 411.

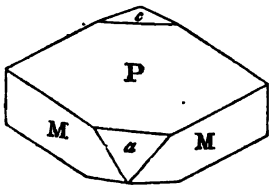
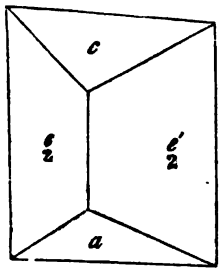
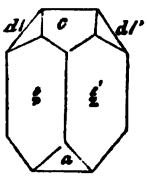


Fig. 412.



Arendal, Norway—Roger's Rock, Lake George.

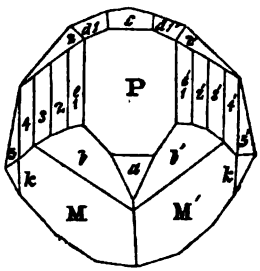
Fig. 413.



Arendal, Norway—Roger's Rock, Lake George.

Fig. 414.

Fig. 415.



St. Gothard.

P on *a*	159°	44′	PRISMS.	M on *c*	120°	2′
P on *c*	140	52		*b* on *b*	167	0
P on *e*2	158	18		*b* on *c*	139	30
P on *e*3	154	20		*c* on *d*1	146	44
P on *e*4	146	30		*c* on *e*2	145	18
P on *e*5	120	2		*c* on *e*4	154	52
M on *a*	139	30		*d*1 on *d*1′	113	24
M on *b*	124	35		*d*2 on *d*2′	135	60
M on *c*	86	20		*d*2 on *e*4	152	30
M on *e*2	119	35		*d*1 on *e*2	152	45
M on *e*3	116	42		*e*1 on *e*1′	175	42
M on *e*5	138	42		*e*2 on *e*2′	136	40
M on *l*	151	20		*e*4 on *e*4′	113	50

Sphene.

Cleavage sometimes distinct in the direction of *d*: traces parallel with M. Fracture imperfectly conchoidal, uneven. Surface, *b* and M almost always faintly streaked, parallel to the edges of combination with *d*. The remaining faces are mostly smooth, and often possess high degrees of lustre.

Lustre adamantine, sometimes inclining to resinous. Color brown, yellow, grey, green; they are not lively, some pistachio-green ones excepted. Streak white. Translucent... translucent on the edges.

Hardness =5·0...5·5. Sp. gr. =3·468, of a massive yellowish grey variety from Norway.

Compound Varieties. Twin-crystals: faces of composition parallel, axis of revolution perpendicular to *c*; sometimes the individuals are continued beyond the face of composition. Massive: composition granular or lamellar, the first are strongly connected.

1. Before the blow-pipe, the yellow varieties do not change their color; all the rest become yellow. They intumesce a little, and melt on the edges into a dark colored enamel. They are soluble in heated nitric acid, leaving behind a siliceous residue.

2. *Analysis.*

	By Klaproth.	By Cordier.
Lime	33·00	32·20
Oxide of titanium	33·00	33·30
Silica	35·00	28·00
Oxide of manganese	a trace	0·00

3. Sphene occurs in small nodules or crystals imbedded in gneiss and beds of sienite and other trap rocks, belonging to them, or to more recent classes of mountains. It is met with in metalliferous beds with ores of iron, several species of Augite Spar and Feldspar: likewise in beds of primitive limestone, and in veins which traverse primitive rocks.

4. It occurs in several districts of the Saualpe in Carinthia, imbedded in coarse grained gneiss; at Hafnerzell in the district of Passau, it occurs

Sphene.

in a bed in gneiss, consisting almost entirely of Augite Spars and Feldspars. At Windisch-Kappel in Carinthia and near Dresden in Saxony, in similarly compound rocks of a newer date. It occurs in beds of iron ore at Arendal in Norway; in veins at St. Gothard in Switzerland, in the Felberthal in Salzburg, and in many other places in the Alps. It is found besides, in France and at several places in Scotland. It occurs in Canada, at Grenville associated with Tabular Spar and Plumbago.*

It is found in the greatest abundance in the United States, at Roger's Rock on Lake George, disseminated in small brown crystals through an aggregate of Feldspar and Pyroxene. A similar variety is found, crystallized and massive, in nodules and geodes with Pyroxene and Petalite, in the limestone of Bolton, (Mass.) In small quantity also, in rounded grains and imperfect crystals, disseminated through limestone with Hornblende, &c., at Edenville and Amity, (N. Y.), and at Trumbull, (Conn.)

Spherosiderite. (See *Spathic Iron.*)

Spherostilbite.

Massive: globules formed in vesicular cavities. Composition columnar, radiating from the centre.

Lustre pearly, very brilliant on the fracture.

Fibres flexible. Surface of the globules scratched by the nail. Sp. gr. =2·31.

1 Fusible before the blow-pipe, with exfoliation and effervescence. Forming a jelly with the acids. The solution yields a precipitate with the oxalate of ammonia.

2. *Analysis.*

By Beudant.

from Faroe.

Silica	55·91
Alumina	16·61
Lime	9·03
Soda	0·68
Water	17.84

* The specimens from this locality cleave constantly and with great perfection, parallel with a rhombic prism of 123° 30′, which is oblique from an acute edge.

3. It occurs, implanted upon Stilbite from Faroe.

4. Its properties as given above, do not appear to justify the formation of a new species.

SPHERULITE. (See *Pitchstone.*)

SPINEL. Dodecahedral Corundum. MOHS.

Primary form. Regular octahedron.

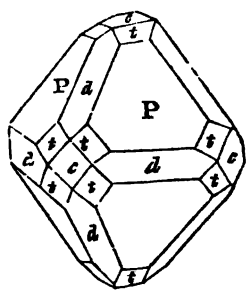
Secondary forms.

1. Primary with edges truncated. Hamburg, (N. J.)

2. Primary with edges bevelled. Vesuvius.

3. Primary with edges and angles truncated. Hamburg, (N. J.)

4. Fig. 416.



Hamburg, (N. J.)

5. Primary with edges replaced by three planes, and angles by four planes resting on the primary faces. Vesuvius.

Cleavage parallel with the primary form difficult. Fracture conchoidal. Surface smooth, the faces *t* sometimes striated parallel to the edges of combination with the octahedron.

Lustre vitreous. Color red, passing into blue and green, also into yellow, brown and black. Sometimes nearly

white. Streak white. Transparent... translucent, only on the edges, if the color be very dark.

Hardness =8·0. Sp. gr. =3·523, of a transparent variety, between cochineal-red and carmine-red.

Compound Varieties. Twin-crystals, face of composition parallel, axis of revolution perpendicular to a face of the octahedron. Sometimes parallel to several faces of the octahedron.

1. The red varieties, exposed to heat, become black and opake; on cooling they appear first green, then almost colorless, and at last, reassume their red color. With borax, they fuse with difficulty, with salt of phosphorus a little more easily. The dark colored varieties yield a deep green globule. Spinel assumes positive electricity by friction.

2. *Analysis.*

Analysts.	Varieties and localities.	Alumina.	Silica.	Magnesia.	Oxide of iron.	Lime.	Total.
Berzelius.	Blue, Aken.	72·250	5·450	14·830	4·260	0·000	96·59
Klaproth.	Red.	74·500	15·500	8·250	1·500	0·750	98·50
Descotils.	Greenish black, Ceylon.	68·000	2·000	12·000	16·000	0·000	98·00
Thomson.	Green, Hamburg, (N. J.)	73.308	5.620	13·622	7·420 protox.	trace	99·98
Thomson.	Black, Amity, (N. Y.)	61·788	5·596	17·868	16·564 protox.	2·804	98·72
Abich.	Black, Vesuvius.	67·460	2·380	25·950	5·060 protox.	1·100	100·00
Abich.	Red? Ceylon.	69·010	2·020	26·210	0·710	1·100 protox. chrome.	

3. Crystals from Ceylon and from several places in the United States, occur imbedded in white limestone. It is found also in veins with Calcareous Spar in serpentine, and in gneiss. Other varieties belong to druses in volcanic rocks. Besides which, it is found abundantly in more recent deposits, formed by diluvial or alluvial action, along with crystals of Corundum, Zircon and other gems.

4. The red, transparent crystals are almost exclusively brought from Ceylon, where they occur in the sand of rivers. In Südermanland in Sweden, bluish and pearl-grey varieties occur imbedded in granular limestone. Dark colored crystals, called *Pleonaste*, are found in Ceylon in sand, and in implanted crystals on Vesuvius.

The United States afford some very remarkable varieties of the present species; the most distinguished of which is one of a black color in crystals, varying from one to sixteen inches in circumference, which is found at Amity, (N. Y.) These crystals exist in groups, often lining the sides of partial veins with Calcareous Spar and Crichtonite in serpentine. They are often in twin-crystals. The same neighborhood produces an abundance of smaller crystals of various shades of green, black, red and brown, and which are imbedded in granular limestone, usually associated with Brucite, Hornblende and Pyroxene. The secondary forms above quoted are found at Hamburg, (N. J.) where they are found in Calcareous Spar and Quartz, associated with Scapolite. They present rich shades of green and blue, and frequently the crystals are transparent. Pearl-grey crystals, simple and compound are found at Newton, (N. J.) in limestone accompanying the blue Corundum, Tourmaline and Rutile. Black Spinel has been found at Munroe, (N. Y.) Green and blue, and more rarely red varieties occur in Bolton, Boxborough and Littleton, (Mass.) imbedded in white limestone.

SPINELLANE. (See *Sodalite.*)

SPODUMENE. Prismatoidal Disthene-Spar.

Primary form. Oblique rhombic prism. M on M = 93°.

Cleavage, parallel to the shorter diagonal of the prism, perfect also to bases oblique to the obtuse edge of the prism and forming with it angles of 135° ... 138°, less perfect than the former. In distinct cleavages also, apparently forming tangent truncations of the acute solid angles. Fracture uneven.

Lustre pearly. Color various shades of greyish-green; passing into greenish-white. Streak white. Translucent.

Brittle. Hardness = 6·5 ... 7·0. Sp. gr. = 3·170.

Compound Varieties. Massive: composition granular, of various sizes of individuals, generally large.

Spodumene.

1. If exposed to the heat of the blow-pipe, it loses transparency and color, intumesces, exfoliates and then melts into a nearly colorless transparent glass.

2. *Analysis.*

	By Arfvedson.	By Thomson. from Ireland.
Silica	66·40	63·313
Alumina	25·30	28·508
Lithia	8·85	5·604
Oxide of iron	1 45	0·728
Oxide of manganese	0·00	0·828

3. It occurs in primitive rocks, particularly in granite, associated with Quartz, Mica, Albite and Tourmaline.

4. It was first discovered at Utön in Sudermanlan, Sweden; but was afterwards found also at Sterzing in the Tyrol, and Killiney in Ireland.

It was first found in the United States, at Goshen, (Mass.) though it passed for some time under the name of Augite. Two deposits of it exist in that town, both of which are in granite; at one of them, it is associated with blue Tourmaline and Beryl. It exists also in the neighboring town of Chesterfield, and at Sterling, in the same state.

Appendix to Spodumene.

1. *Killinite.* The mineral described under this name, is found at Killiney near Dublin in Ireland, associated with Spodumene, with which it agrees in the cleavages, and from which it differs in hardness and sp. gr. Its hardness = 4·00 and Sp. gr. = 2·698. These differences however, appear to depend upon incipient decomposition. Before the blowpipe it becomes white, intumesces and melts into a white enamel.

Analysis.

	By Barker.	By Lehunt.	By Blythe.
Silica	52·49	49·08	47·975
Alumina	24·50	30 60	31·041
Potash	5·00	6·72	6·063
Protoxide of iron	2·49	2·27	2·328
Lime	0·00	0·68	0 724
Magnesia with manganese	0·00	1·08	0·459
Protoxide of manganese	0·75	0·00	1·255
Water	5·00	10·00	10·000

Its difference in composition from the Spodumene, it will be seen, arises from the presence of water, and the substitution of potash for lithia.

STAUROTIDE. Prismatoidal Garnet. MOHS.

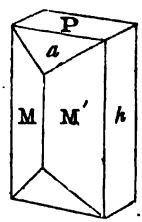
Primary form. Right rhombic prism. M on M = 129° 31′.

Secondary forms.

1.

Primary form with the acute lateral edges truncated.

2. Fig. 417.



M on a = 137° 58′.

Cleavage, h perfect but interrupted, M in traces. Fracture conchoidal, uneven. Surface P sometimes very rough and corroded, hollowed out in the centre. The rest of the faces generally of the same quality either rough or smooth.

Lustre vitreous, inclining to resinous. Color reddish-brown, or brownish-red, very dark. Streak white. Translucent, frequently on the edges.

Hardness = 7·0 . . . 7·5. Sp. gr. = 3·724, crystals from St. Gothard; that of columnar twin-crystals from Spain, the substance of which is less homogeneous, is between 3·3 and 3·4.

Staurotide.

Compound Varieties. Twin-crystals. Face of composition parallel, axis of revolution perpendicular to the longer diagonal of the prism. Angle of revolution =90; fig. 418. Face of composition parallel, and axis of revolution perpendicular to a face replacing the terminal edges, angle of revolution = 60, fig. 419. The individuals in both cases, are continued beyond the face of composition, and produce cruciform groupes. By the addition of a third individual to the latter, groupes resembling stars with six radii, are formed.

Fig. 418.

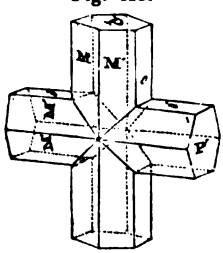
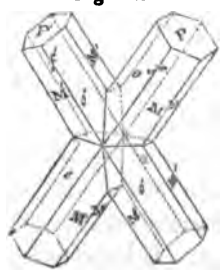


Fig. 419.



1. Before the blow-pipe this species does not fuse, but only assumes a dark color.

2. *Analysis.*

	By VAUQUELIN. from Brittany.	By KLAPROTH. from St. Gothard.
Silica	33·00	37·50
Alumina	44·00	41·00
Lime	3·84	0·00
Magnesia	0·00	0·50
Oxide of iron	13·00	18·25
Oxide of manganese	1·00	0·50

3. It occurs in imbedded crystals in primitive rocks, particularly in mica-slate, in simple and compound crystals, accompanied by Kyanite, Garnet, &c.

4. Simple crystals occur on St. Gothard in Switzerland, and the Greiner Mountain in Zillerthal in the Tyrol, sometimes curiously aggregated

with crystals of Kyanite, into a continuous mass with parallel axes, the perfect planes of cleavage of the two crystals being coincident. Twin-crystals occur in Spain, Portugal, France, Scotland and Brazil.

It is particularly abundant in the mica-slate region of the United States. The most interesting localities for the size and perfection of its crystals are, Franconia, (N. H.) New York, three and a half miles from the city, Bolton and Tolland, (Conn.) Chesterfield, (Mass.) Harpswell and Winthrop, (Maine.)

STEATITE. (See *Talc.*)

STEINHEILITE. (See *Iolite.*)

STERNBERGITE. Monotomous Polypoione-Glance.

Primary form. Right rhombic prism. M on M $=119^{\circ}$ $30'$.

Secondary form. Primary form, with the acute edges truncated.

Cleavage, highly perfect parallel to P; the laminæ may be torn asunder like thin sheet-lead.

Lustre metallic. Color dark pinch-beck brown. Streak black. Tarnish often violet-blue.

Very sectile. Thin laminæ perfectly flexible. Hardness $=1{\cdot}0 \ldots 1{\cdot}5$. Sp. gr. $=4{\cdot}215$.

Compound Varieties. Globular, or rose-like aggregations. Massive: composition granular.

1. Alone on charcoal, it burns with a blue flame and sulphurous odor, and melts into a globule generally hollow, with a crystalline surface, and covered with metallic silver. The globules act strongly on the magnetic needle.

2. *Analysis.*
By ZIPPE.

Silver	33·20
Iron	36·00
Sulphur	30·00

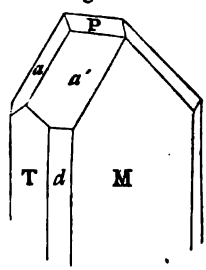
3. It is found along with other ores of silver, at Joachimsthal in Bohemia.

STILBITE. Prismatoidal Kouphone Spar. MOHS.

Primary form. Right rectangular prism.

Secondary form.

Fig. 420.



Faroe.

M on *a'*	-	-	120°	30′	PHILLIPS.
a on *a'*	-	-	118	50	"
M on *d*	-	-	133	30	"

Cleavage, parallel to M and T, the former of which, only is perfect. Fracture uneven. Surface P often curved, M vertically streaked, T still more so.

Lustre vitreous. The faces M, both as faces of crystallization and of cleavage, exhibit a perfect pearly lustre. Color white prevalent, various shades of yellow, red and brown. Streak white. Semi-transparent . . . translucent.

Brittle. Hardness = 3·5 . . . 4·0. Sp. gr. = 2·161, white crystals from Iceland.

Compound Varieties. Twin-crystals which assume a cruciform aspect,. but rare. The crystals are frequently aggregated in the form of a sheaf. Implanted globules, surface very drusy, composition, imperfectly columnar, and

strongly cohering. Massive: composition imperfectly columnar, individuals broad, straight, and radiating from common centres strongly coherent. Often these compositions are again aggregated iuto granular masses. Globular shapes formed in vasicular cavities.

1. Before the blow-pipe, it yields an opake vesicular globule. It does not gelatinize with acids.

2. *Analysis.*

By Hisinger.

Alumina	16·10
Silica	58·00
Lime	9·20
Water	16·40

3. Its principal repositories are, the vesicular cavities of amygdaloidal rocks, and certain metalliferous veins. It is also found lining seams in gneiss. The accompanying minerals are Heulandite and Chabasie, and when in metallic veins, it is generally attended by ores of silver, lead, copper and iron.

4. Magnificent crystals of a white color are met with in the vesicular cavities of the amygdaloids of Iceland and the Faroe Islands. Similar varieties have been brought alsofrom Indore in the Vendyah mountains in the East Indies. Those from the Tyrol are mostly compound and of a brick-red color. Beautiful crystals of this color occur near Campsie in Sturlingshire, though the present species is less common in Scotland and the Western Isles, than that of Heulandite. The crystals from the silver veins of Andreasberg in the Hartz are generally small, so are also those which occur in the iron mines of Arendal and in the beds of copper-ore in the Bannat of Temeswar. Handsome varieties of a white color occur in the Basin of Mines, Nova Scotia, in trap, attended with other species of this family.

But few localities of Stilbite are known in the United States; and these generally unimportant. The most interesting is that at Hadlyme, (Conn.) where it lines the walls of seams in gneiss in stellular concretions of considerable dimensions, associated with Chabasie, Heulandite and Epidote. Under similar circumstances, it occurs at West Farms, (N. Y.) and Bellows falls, (Vt.) It has been met with at Saybrook in gneiss in small reddish crystals associated with Molybdenite. Also in small quantity, in vesicular cavities of greenstone trap at various places in Connecticut and Massachusetts.

STILPNOMELAN.

Massive; composition laminar and granular. Cleavage in one direction perfect.

Lustre vitreous. Color black. Streak, olive-green to liver-brown.

Hardness = 3·0 . . . 4·0. Sp. gr. = 2·769, BREITHAUPT, 3·0 . . . 3·4, GLOCKER.

1. It is found at Obergrund in Silesia.

STILPNOSIDERITE. (See *Limonite.*)

STRIEGISAN.

Primary form. Right rhombic prism. M on M = 122° 15′.

Secondary form, the obtuse angles of the primary form replaced so as to give rise to dihedral summits inclining to each other under angles of 107° 26′, and the lateral edges also replaced.

Cleavage parallel to the sides and the shorter diagonal of the primary form.

Lustre vitreous to pearly. Color grey, brown and black.

Hardness (scale of BREITHAUPT,) = 6·0 . . . 7·0. Sp. gr. = 2·354 . . . 2·379.

1. It is found at Striegis in Frankenberg.
2. It is probably identical with Wavellite.

STROMEYERITE. Uncleavable Polypoione-Glance.

Massive: composition impalpable. Fracture flat conchoidal to uneven.

Lustre metallic. Color blackish lead-grey. Streak shining.

Hardness = 2·5. Sp. gr. = 6.225.

1. It fuses very easily before the blow-pipe, attended with the odor of sulphureous acid, but without effervescence or the formation of a scoria. The globule has a grey color, a metallic lustre, is tarnished on the upper side, is semi-ductile and grey within. It is soluble in nitric acid; the solution affording the indication of copper on the immersion of an iron-plate, and of silver on the introduction of a copper one.

2. *Analysis.*

By STROMEYER.

Sulphur	15·96
Silver	52·87
Copper	30·83
Iron	0.34

3. It is found in small masses in the mines of Schlangenberge in Siberia.

STROMNITE.

Massive; composition thin columnar, and showing traces of crystallization.

Color yellowish-white internally; on the outside where it appears to be disintegrated, it is greyish-white. Lustre inclining to pearly, faint. Translucent.

Brittle. Hardness =3·5. Scratches Calcareous Spar, but not Fluor. Sp. gr. = 3 703.

1. It effervesces with acids, but is infusible before the blow-pipe.

2. *Analysis.*

By TRAILL.

Carbonate of strontita	68·6
Sulphate of barytes	27·5
Carbonate of lime	2·6
Oxide of iron	0·1

3. It occurs in veins with Galena in a kind of clay-slate, at Stromness in Orkney.

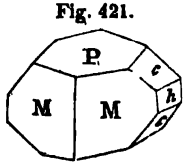
4. It seems probable that the Stromnite is a mixed mineral, consisting of an intimate aggregation of Strontianite and Heavy-Spar.

STRONTIANITE. Peritomous Hal-Baryte. MOHS.

Primary form. Right rhombic prism. M on M = 117° 32′.

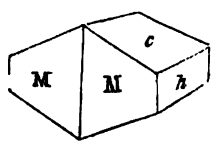
Secondary forms.

Fig. 421.



Braundsdorf, Saxony.

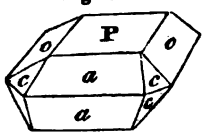
Fig. 422.



Leogang, Salzburg.

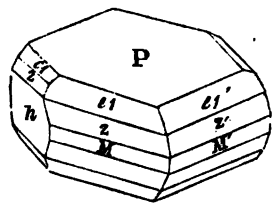
Strontianite.

Fig. 423.



Schoharie, (N. Y.)

Fig. 424.



M on *h* - - -	121°	30′	PHILLIPS.
e′ on *e*1 - - -	108	12	"
*e*1 on *e*2 - - -	144	20	"
h on *c*1 - - -	126	5	"
h on *c*2 - - -	143	30	"
*c*1 on *c*2 - - -	160	35	"

Cleavage, parallel with M rather perfect; with *c* less easily obtained, faint traces observable in the direction *h*, or at least, small conchoidal fracture. Fracture in other directions, uneven. Surface P often rough, though even, and streaked, parallel to the edges of combination with *c*. M deeply streaked in a horizontal direction, and hence the crystals often in curved, barrel-shaped, prisms. The other planes generally smooth.

Lustre vitreous, slightly inclining to resinous upon the uneven faces of fracture. Color asparagus-green, and apple-green; pale yellowish-brown, yellow and grey; white. Streak white. Transparent... translucent.

Brittle. Hardness =3·5. Sp. gr. =3·605, the variety in acicular crystals from Bräunsdorf, near Frieberg.

Compound Varieties. Twin-crystals; axis of revolution perpendicular, face of composition parallel to a face of M. The individuals generally continued beyond the face

of composition. This composition is very similar to some that occur in Arragonite. The product of it is a six-sided prism, having four edges of 117° 19′ and two of 128° 22′. As in that species, particles of the two individuals alternate in parallel layers with each other. Indistinct globular masses. Surface drusy, composition columnar. Massive: composition columnar, the individuals generally straight, long and a little divergent; the composition is seldom granular.

1. It melts before the blow-pipe at a temperature not very elevated, but only on the thinnest edges. It intumesces and spreads a brilliant light, the flame at the same time assumes a reddish hue. It is dissolved by borax with a violent effervescence into a clear globule. It is soluble with effervescence in muriatic and nitric acids: and paper dipped into this solution and afterwards dried, will burn with a red flame.

2. *Analysis.*

By Klaproth.

Strontita	69·50
Carbonic acid	30·00
Water	00·50

3. The repositories of this species, are metallic veins traversing primitive and transition mountains. It seems also to occur in beds.

4. It was first discovered at Strontian in Argyleshire in Scotland, and found afterwards at Braunsdorf in Saxony in large crystals, at Leogang in Salzburg, and also in Peru. It has of late been found, in abundance at Schoharie, (N. Y.) disseminated in geodes and nests through water-limerock; also in large veins or beds. In one of these last, it exists in a mass of such extent and purity as to have attracted attention as a marble quarry.

Sulphate of Alumine. (See *Solfatarite.*)

Sulphate of Ammonia. (See *Mascagnine.*)

Sulphate of Barytes. (See *Heavy Spar.*)

Sulphate of Cobalt. (See *Cobalt-Vitriol.*)

Sulphate of Copper. (See *Blue-Vitriol.*)

Sulphate of Iron. (See *Copperas, Pittizite White Copperas* and *Yellow Copperas.*)

SULPHATE OF LEAD. (See *Anglesite.*)
SULPHATE OF LIME. (See *Gypsum.*)
SULPHATE OF MAGNESIA. (See *Epsom-Salt.*)
SULPHATE OF POTASH. (See *Aphthitalite.*)
SULPHATE OF SODA. (See *Glauber-Salt.*)
SULPHATE OF STRONTIAN. (See *Celestine.*)
SULPHATE OF ZINC. (See *White-Vitriol.*)
SULPHATO-CARBONATE OF LEAD. (See *Dyoxylite.*)
SULPHATO-TRI-CARBONATE OF LEAD. (See *Leadhillite.*)

SULPHO-SELENITE. Selenous Brittle-Sulphur.

Massive: in thin seams.

Color brown.

1. It is a sulphuret of selenium.

2. It occurs with Sal-Ammoniac in the crater of Volcano, one of the Lipari islands; and probably with Iron Pyrites at Fahlun, Sweden.

SULPHUR. Prismatic Brittle-Sulphur.

Primary form. Octahedron with rhombic base. P on P″=106° 20′.

Secondary forms.

Fig. 425.

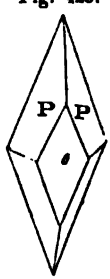


Fig. 426.

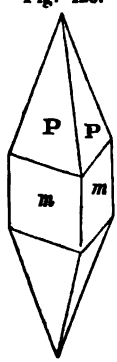
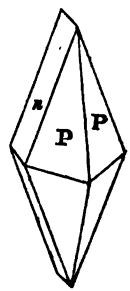


Fig. 427.



Sulphur.

Fig. 428.

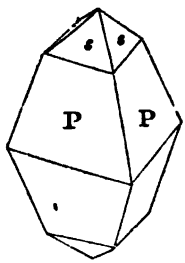
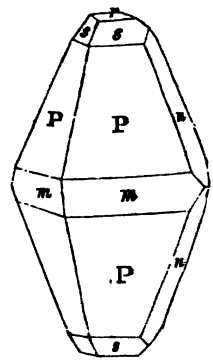


Fig. 429.



P on P	-	-	-	106°	38′
P on P over *n*	-	-	-	84	58
s on *s*	-	-	-	127	1
n on *n*	-	-	-	124	24
m on *m*	-	-	-	101	59
P on P over *m*	-	-	-	143	26
s on *r*	-	-	-	179	45

Fig. 425. Primary having the obtuse angles of the base truncated. (*unitaire*. Hauy.)—Fig. 426. Primary having the edges of the base replaced by tangent planes. (*primé*. H.)—Fig. 427. Primary having the acute, pyramidal edges replaced by tangent planes. (*émoussé*. H.)—Fig. 428. Primary with summit, replaced by four planes resting upon the primary faces. (*dioctaèdre*. H.)—Fig. 429. (*equivalent*. H.)

Cleavage, parallel with P and *m* imperfect, obtained with difficulty, and interrupted. Fracture conchoidal, sometimes highly perfect. Surface *n* commonly rough, the rest of the faces generally smooth and shining, possessing nearly the same physical quality.

Sulphur.

Lustre resinous. Color, several shades of sulphur-yellow, inclining sometimes to red or green. Streak sulphur-yellow, passing into white. Transparent . . . translucent on the edges.

Sectile. Hardness = 1·5 . . . 2·5. Sp. gr. = 2·072.

Compound Varieties. Twin-crystals: axis of revolution perpendicular, face of composition parallel to a face of *r*. Imbedded globules: surface uneven; composition impalpable, often impure. Massive: composition granular, often impalpable, strongly coherent; fracture uneven, even, flat conchoidal. Sometimes pulverulent.

1. Sulphur as it occurs in nature is pure, or is only mixed with bitumen or clay. It acquires resinous electricity by friction, is easily inflammable, and burns with a blue or white flame, and a pungent smell of sulphurous acid. It is insoluble in water, but unites readily with potash or soda. It may be obtained crystallized by sublimation, or still more easily from solutions in liquids. The forms of sulphur, crystallized from fusion, are incompatible with those of the present species. They are generally oblique rhombic prisms of 90° 32′, the terminal face of which is inclined to the obtuse edge of the prism, which is itself commonly replaced at an angle of 95° 46′. It occurs almost always in regular compositions. The crystals are at first transparent, but they soon become opake.

2. Sulphur is generally met with in beds of Gypsum or in the accompanying strata of clay. It is generally associated with Calcareous Spar and with Celestine. It occurs in veins with Copper Pyrites, Galena, and Orpiment. It is deposited from several thermal springs and in large quantities from volcanos; sometimes it occurs in beds of Bituminous Coal.

3. Sulphur is found in splendid crystals and pure massive varieties, also, in globular concretions, (which however, are seldom without earthy or bituminous admixtures) in Sicily, and several provinces of Italy. It occurs in imbedded spheroidal masses of a brown color, which is owing to bitumen at Radoboy, near Crapina in Croatia. Near Cracovia in Poland, it is likewise met with more or less in pure massive varieties and small crystals. The finest crystals, excepting those from Sicily,

come from Cadiz in Spain. Small crystals have been observed investing the brown coal from Artern in Thuringia. It occurs in veins in Swabia, in Spain and in Transylvania. The earthy Sulphur is found in Poland, in Moravia, and other countries; the volcanic Sulphur in Iceland, near Vesuvius, in Milo and several islands of the Grecian Archipelago; in great profusion near the volcanos of Java and the Sandwich islands. Sulphur also occurs in Savoy, in Piedmont, in Switzerland, at Lauenstein in Hanover, in South America, and many other countries.

4. It requires to be purified, either by melting or by sublimation, in order to be employed in the arts. It is used in the manufacture of gunpowder, of cinnabar, sulphuric acid, and of several pharmaceutical preparations.

SULPHUREOUS ACID. Aeriform Sulphurous-Acid. Mohs.

Gaseous. Transparent.

Sp. gr. = 2·2553. Thenard and Gay-Lussac.
= 2·2295. Davy.

Odor pungent. Taste acid.

1. According to Berzelius, Sulphurous-Acid Gas is composed of

Sulphur	50·144
Oxygen	49·856

It is fatal to life, and extinguishes combustion. It reddens, and finally destroys vegetable blues. It becomes liquid at a temperature of 0° Fahr., or under a pressure equal to two atmospheres. Water, at 61° Fahr., absorbs 33 times its bulk of this gas, or nearly one eleventh of its weight.

2. It is evolved in great quantities from the waters of active volcanos, as those of Etna and Mount Vesuvius, and those of the Sandwich Islands. When emitted along with sulphuretted hydrogen, a mutual decomposition results, and incrustations of sulphur are formed, as in the volcano of Puracé, near Popayan. It occurs likewise, along with carbonic acid, in a cave which is situated in the Büdös hegy, a porphyry hill in Transylvania, on the frontiers of Moldavia.

3. Sulphurous-Acid Gas, artificially generated by the combustion of sulphur in common air, is used in bleaching silks; likewise, for discharging vegetable stains and iron-moulds from linen.

Sulphuretted Hydrogen.

SULPHURET OF ANTIMONY. (See *Grey Antimony.*)
SULPHURET OF BISMUTH. (See *Bismuthine.*)
SULPHURET OF COBALT. (See *Cobalt Pyrites.*)
SULPHURET OF COPPER. (See *Vitreous Copper.*)
SULPHURET OF LEAD. (See *Galena.*)
SULPHURET OF MANGANESE. (See *Manganblende.*)
SULPHURET OF MERCURY. (See *Cinnabar.*)
SULPHURET OF MOLYBDENA. (See *Molybdenite.*)
SULPHURET OF SILVER. (See *Vitreous Silver.*)
SULPHURET OF TIN. (See *Tin Pyrites.*)
SULPHURET OF ZINC. (See *Blende.*)

SULPHURETTED HYDROGEN. Sulphureous Hydrogen-Gas. MOHS.

Amorphous. Transparent. Expansible.

Sp. gr.=1·181.

Odor of putrid eggs.

1. It does not support combustion; it blackens most of the metals, and becomes fatal to animals, if inhaled in any considerable quantity.

2. *Analysis.*

By BERZELIUS.

Hydrogen	5·824
Sulphur	94·176

3. It is developed from sulphureous waters, both cold and warm, as at Neundorf in Westphalia, and at Baaden near Vienna; also from swamps and marshes. In Italy, it is disengaged from the soil of the *Solfataras*, and of the *Fumacchio*, sometimes mixed with other kinds of gas.

In the U. States, it has been observed at numerous springs throughout New York, Ohio, and other western states. On the western bank of Niagara river, a mile south of the Falls, it issues from a bank, which consists of a shelly limestone, including thin beds of coal and Iron Pyrites; under similar circumstances also at Otsquaga creek. It abounds particularly in the boiling springs of Florida.

SULPHURIC ACID. Liquid Sulphuric-Acid. Mohs.

Liquid. Transparent, in different degrees.

Sp. gr. = 1·846 Ure, when pure, but varies to a little above 1·0 according to its dilution. Taste strongly acid and caustic.

1. The anhydrous sulphuric acid is solid, and, according to Berzelius, consists of

Sulphur	40·14
Oxygen	59·86

This is obtained from the first portions which come over from the distillation of fuming sulphuric acid; the fumes concrete upon the sides of the receiver in tough, silky filaments, which are entirely free from water. The strong, liquid sulphuric acid, contains at least 18·5 p. c. of water. When it is diluted to a sp. gr. of 1·780, it crystallizes at 45° F.; when of a sp. gr. between 1·786 and 1·775 at 32°, and when it is as high as 1·843, at —15°. The crystals have the figure of six-sided prisms terminated by six-sided pyramids. Common sulphuric acid is an oily looking fluid, limpid and inodorous, and eminently destructive of animal and vegetable bodies. It rapidly absorbs moisture from the air, and evolves heat when mingled with water in every proportion.

2. It is produced in many places from the decomposition of water and Iron Pyrites. A remarkable locality of it, called the *sour spring*, exists in Byron, Genesee co. (N. Y.) near the Erie canal. The acid is produced from a hillock 230 feet long and 100 broad, elevated about five feet above the surrounding plane. It contains an abundance of Iron-Pyrites in exceedingly minute grains; and is covered with a coat of charred vegetable matter to the depth of four or five inches, occasioned by the action of the sulphuric acid. Wherever holes have been sunk in this hill, the acid accumulates; also in the depressions in the contiguous meadow ground. When the season is dry, it collects in a perfectly concentrated state. This acid, similarly produced, occurs in a cavern near Sienna in Tuscany, and at Aix in Savoy. A considerable lake of it exists in the ancient crater of Mount Idienne in Java; and a stream of it, called the Rio de Vinegro, flows from the extinct volcano Puracé near Popayan, whose waters are fatal to fish, and the spray arising from them irritating to the eyes of animals.

3. Sulphuric acid, or *oil of vitriol*, which is artificially produced from the combustion of sulphur in contact with a little nitre, is of very extensive use in chemistry, as well as in metallurgy, bleaching and some of the processes for dyeing; it is also employed in the formation of numerous salts, as copperas, sulphate of magnesia, &c., and is administered in medicine as a tonic and stimulant, and sometimes used externally as a caustic.

SYLVITE.

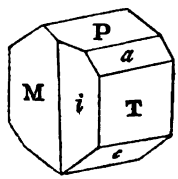
Soluble with the taste of Common Salt, and crystallizable from solution in cubes, parallel to whose faces it cleaves. The aqueous solution affords a yellow precipitate on the addition of muriate of platina. Treated with sulphuric acid, it leaves after evaporation acicular crystals, which do not effloresce in the air. It is supposed to be muriate of potash; and is found in small quantity, mingled with Common Salt, in the mines of Hallein, and of Berchtesgaden.

TABULAR-SPAR. Tetarto-prismatic Tabular-Spar.

Primary form. Doubly oblique prism. P on T=126°? P on M=93° 40′. M on T=95° 15′.

Secondary form.

Fig. 430.



M on *i*	-	-	139°	48′	PHILLIPS.
T on *i*	-	-	135	30	"
P on *a*	-	-	156	30	"
P on *e*	-	-	94	15	"

Cleavage, in the direction of M and T easily obtained, but one of them more perfect than the other; parallel with P indistinct. Fracture uneven.

Tabular-Spar.

Lustre vitreous, inclining to pearly upon M and T. Color white, inclining to grey, yellow, red and brown. Streak white. Semi-transparent . . . translucent.

Rather brittle. Hardness = 4·0 . . . 5·0. Sp. gr. = 2·805.

Compound Varieties. Long individuals produce a reticulated composition; the composition apparently taking place parallel with a plane in the direction of *a*, and inclining to T under about 140°. (Grenville, Lower Canada.) Massive: composition lamellar, generally longish, and aggregated into a second large grained and angular composition. Strongly coherent.

1. Before the blow-pipe, it melts on the edges into a semi-transparent colorless enamel. It requires a strong heat for melting, and sometimes boils a little. It is easily dissolved by borax, forming with it a transparent globule. By fusing lime and silica in the required proportions, cleavable masses of the present species have been obtained.

2. *Analysis.*

	By Stromeyer.	By Rose.
Silica	51·455	51·60
Lime	47·412	46·41
Protoxide of iron	0·401	a trace.
Oxide of manganese	0·257	0·00
Water and loss by heating	0·076	0·00
Mechanical admixtures	0·000	1·11

3. The oldest variety known is from Czcklowa near Orawitza, in the Bannat of Temeswar, where it occurs in several copper mines. In Finland, it occurs in limestone; at Edinburgh, in the greenstone of Castlehill. The variety called *Wollastonite*, from Capo di Bove near Rome, occurs in lava, resembling basalt. A very handsome greenish white variety, in large individuals, occurs in limestone bowlders at Grenville in Lower Canada.

In the United States are two localities; one at Willsborough, (N.Y.) where the mineral forms the sides of a powerful vein of Garnet, which traverses a mountain of gneiss: the other is at Easton in Pennsylvania, where it exists in limestone.

TACHYLITE. (See *Pitchstone.*)

TALC. Prismatic Talc-Mica. MOHS.

Primary form. Right rhombic prism. M on M=120° nearly.

Secondary form. Primary, having its acute lateral edges replaced by tangent planes.

Cleavage, parallel with P, commonly very perfect. Fracture not observable. Surface, P smooth, the other planes striated horizontally.

Lustre pearly upon P, both as faces of crystallization and cleavage. The other faces possess vitreous lustre, inclining to adamantine, generally low degrees.

Color various shades of green, as blackish green, leek green, celandine-green, and apple-green, passing into greenish grey, greenish white and greyish white. Streak corresponding to the color, green... white. Semi-transparent... translucent. Different colors in different directions. Some individuals are of a bright green color if viewed in a direction perpendicular to the laminæ, while parallel to them they exhibit a fine brown tinge. In the latter direction they are much more transparent than in the former.

Sectile, in a high degree. Thin laminæ are easily flexible. Hardness=1·0...1·5. Sp. gr. = 2·713, a dark green variety.

Compound Varieties. Imperfect globules and stellular groupes: composition imperfectly columnar. Sometimes several crystals are engaged with each other, so as to produce conical and cylindrical aggregations. Massive: composition granular, of various sizes of individuals, often impalpable; sometimes imperfectly columnar. The individu-

als are sometimes strongly coherent with each other or flat, so as to give rise to an imperfectly slaty structure. Often earthy, without connexion of its particles.

1. The differences among the varieties comprehended within the present species, depend upon various properties of the individuals themselves, upon diversities in their composition, and the presence of foreign matter. The varieties of dark green (leek-green, celandine green, &c.) colors, inclining to brown, constitute the *chlorite*, subdivided into *foliated* and *common*, *slaty* and *earthy* chlorite. The first of these contains the crystallized varieties, and such compound ones as consist of easily separable individuals, not presenting a slaty structure. The second contains those granularly compound varieties in which the individuals can scarcely be traced, or in which they are not observable at all. Chlorite-slate, or slaty-chlorite, refers to such compound varieties as have a slaty texture; and earthy-chlorite to such as are but loosely coherent, or already in a state of loose scaly particles. Immediately with those varieties of Chlorite whose composition is impalpable, the *Green Earth* is connected; from which, however, must be excepted what has been termed crystallized Green Earth, and which, consists of decomposed crystals of Pyroxene. Common Talc embraces crystallized varieties, and such compound ones in which cleavage is transformed into slaty structure, the latter being generally very perfect; or such as consist of columnar particles of composition. Earthy Talc, or *Nacrite*, consists of loose particles, or such as are but slightly cohering; *Indurated Talc* refers to imperfect and coarse slaty varieties, in which this kind of structure is more the consequence of composition than of imperfect cleavage. If this structure be sufficiently imperfect to become coarse, and indistinctly granular, *Pot-stone*, or *Lapis ollaris* is formed, which possessing the united properties of softness and tenacity, may be easily turned into vessels; for which reason only it appears to have been regarded as a distinct species. Closely connected with this variety, is the Steatite, which often occurs in coatings and pseudomorphoses, and the soapstone, which is white, or mottled red and green.

2. Before the blow pipe, Talc offers, according to its color and foreign admixtures, various appearances. In general it loses its color, and is with difficulty fused, or changed into a black scoria, or is altogether infusible.

Talc.

8. *Analysis.*

Analysts.	Varieties.	Silica.	Magnesia.	Alumina.	Iron.	Potash.	Lime.	Water.	Total.
VAUQUELIN.	Foliated,	62·000	27·000	1·500	Ox. 3·500	0·000	0·000	6·000	100·000
	Green Earth,	52·000	6·000	7·000	" 23·000	7·500	0·000	4·000	99·500
	Nacrite,	50·000	0·000	26·000	" 5·000	17·500	1·500	0·000	100·000
	Chlorite,	26·000	8·000	18·500	" 43·000	2·000	0·000	2·000	99·500
GRUNER.	Chlorite Slate,	29·500	21·390	15·620	" 23·390	0·000	1·500	7·380	98·780
KLAPROTH.	Foliated,	62·000	30·500	0·000	" 2·500	2·750	0·000	0·000	97·750
LAMPADIUS.	Slaty Chlorite,	35·000	29·900	18·000	" 9·700	0·000	0·000	2·700	95·300
KLAPROTH.	Soapstone of Cornwall,	45·000	24·750	9·250	" 1·000	0·000	0·000	18·000	98·000
	Steatite of Bayreuth,	59·500	30·500	0·000	" 2·500	0·000	0·000	5·500	98·000
WIEGLIB.	Potstone,	38·000	35·000	7·000	" 15·000	0·000	0·000	0·000	97·000
THOMSON.	Chlorite, from Isle of Bute,	27·624	10·960	23·708	Prot. 27·544	0·000	0·000	9·160	98·996
	Chlorite Earth, fr. Highlands of Scotland,	48·166	2·916	16·851	Per. 19·000	6·558	2·675	2·350	98·718
	Venetian Talc,	62·588	30·328	0·000	Prot. 3·848	0·000	0·000	3·400	99·964
	Talcose Slate, from Piedmont,	57·560	27·216	1·720	" 4·716	0·000	7·944	1·600	100·756
	Potstone, from Sweden,	19·010	30·200	6·080	" 11·400	0·000	0·000	4·200	100·890
	Common Talc,	29·364	12·144	17·808	" 26·616	0·000	3·092	11·200	100·234
	Indurated Talc, from Sweden,	39·524	35·080	6·200	" 11·528	0·000	0·000	8·120	100·452
	Cornish Talc, or *Gilbertite*,	45·155	1·900	10·110	" 2·430	0·000	4·170	4·250	98·015
	Soapstone of Cornwall, red,	42·320	25·680	9·384	" 1·083	0·000	4·680	16·960	100·107
	Soapstone of Cornwall, white,	43·884	24·144	9·872	0·000	0·000	0·000	21·228	99·128

4. Common Talc, indurated Talc, Potstone and slaty Chlorite, constitute beds in primitive mountains. The latter frequently contains imbedded crystals of Magnetic Iron; some of the former contain Apatite and Rhomb Spar. Common Chlorite in particular, is found in beds in primitive rocks, consisting chiefly of limestone, Hornblende and Magnetic Iron. Soapstone is found in veins in serpentine, and Steatite, in beds in chlorite slate and in serpentine. The latter often contains the variety of Dolomite called Bitter Spar. Other varieties, and among them the small scaly crystals of foliated Chlorite, occur in veins of various descriptions, and in the crystal caves of the Alps. Green-Earth, and sometimes also foliated Chlorite, occur in amygdaloidal rocks, where they are found either lining the vesicular cavities, or as imbedded nodules in the body of the rock itself. Earthy Talc, or Nacrite, has been found in lead veins.

5. Those varieties which by themselves form mountain masses, are met with in the primitive districts of the Tyrol, Salzburg, Switzerland, Sweden, Norway, Corsica, &c.; in the Grampians in Scotland; in Unst, one of the Shetland isles. Upon beds and veins with metallic ores, &c., they occur in considerable quantity in Cornwall; also in Saxony, Salzburg, and Sweden, &c. The crystallized varieties occur in veins, frequently in Mount St. Gothard, Salzburg and other countries. The chief localities of the green-earth are the Monte Baldo near Verona, Iceland, the Faroe Islands, Tyrol, Hungary and Transylvania.

The United States abound in the present species. Soapstone and Steatite form powerful beds and veins in the western parts of Massachusetts, in New Hampshire, Vermont, and in Rhode Island. At Marlborough, (Vt.) it embraces very perfect crystals of the Rhomb Spar. The same mineral is found in the Steatite of North Providence, (R. I.), but not in distinct crystals. Crystallized varieties are of rare occurrence, except in globular forms, and then in small quantities. Beautiful columnar specimens, of a delicate green color, occur at Smithfield, (R. I.) in Steatite; and white granular varieties at Smithfield, in limestone, in the same vicinity. A handsome green Talc is found at Bridgewater in the talcose slate region, with which is intermingled a transparent massive Dolomite. Chlorite abounds throughout New England, and the chlorite slate formation is traceable from Vermont to Georgia.

6. Some of the varieties of Talc, as Soapstone and Steatite, are used as fire stones in iron-furnaces, in stoves for heating houses, and in culinary vessels. Green earth is used, both raw as a green color, and burnt as a reddish-brown color, for painting houses, &c. The Venetian Talc

was formerly used in medicine, and is now employed in removing oil-stains from woollen cloth.

TANTALITE. (See *Columbite.*)

TAUTOLITE.

Primary form. Right rhombic prism. M on M = 109° 46′.

Secondary form. The primary, having the acute angles, and the acute lateral edges truncated; the former so deeply as to produce a dihedral summit of 51° 52′. The acute lateral edges are also bevelled, the bevelling planes meeting at an angle of 86° 22′.

Cleavage, only in traces, and interrupted parallel to M. Fracture conchoidal... uneven.

Lustre vitreous. Color velvet-black. Streak grey. Opake.

Hardness = 6 5...7·0. Sp. gr. = 3·865.

1. Before the blow-pipe, on charcoal, it melts to a blackish scoria, which is attracted by the magnet; with borax, it melts to a clear green glass. Hence it may be presumed to consist of silica, protoxide of iron, magnesia and alumina.

2. It is found in the volcanic rocks in the neighborhood of Lake Laach in Prussia.

3. It is closely related to Peridot.

TELLURIC BISMUTH. (See *Bornine.*)

TELLURIC LEAD.

Massive.

Cleavages in three directions, apparently leading to the cube.

Lustre shining. Color, tin-white.

Hardness = 3·0. Sp. gr. = 8·159.

1. It colors the flame of the blow-pipe blue. It melts, and is at length reduced to a little button of silver, surrounded by a sublimate of telluret of lead, and a yellowish brown deposit.

2. *Analysis.*

By ROSE.

Lead	60·36
Silver	1·28
Tellurium	38·37

3. It is found with Blende, Iron Pyrites and Telluric Silver, at the mine of Sawodinski in Siberia.

4. It approaches in its properties the Black Tellurium.

TELLURIC SILVER. Telluric Polypoione-Glance.

Massive. Cleavage, in one direction distinct.

Lustre shining. Color between lead grey and steel grey.

Hardness = 2·5 . . . 2·75. Sp. gr. = 8·412.

1. Before the blow-pipe, it melts upon charcoal into a black mass, in which dendrites of silver are visible. It is soluble in cold nitric acid.

2. *Analysis.*

By Rose.

Silver	82·63
Tellurium	37·37

3. It is found with Iron Pyrites, Blende and Telluric Lead, in the mine of Sawodinski, in Siberia.

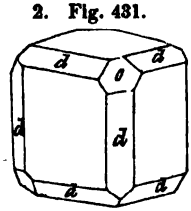
Tennantite.

Primary form. Tetrahedron.

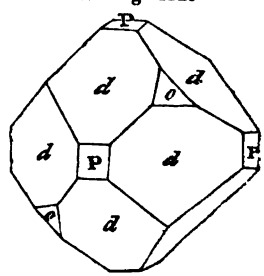
Secondary forms.

1. Tetrahedron, with angles truncated.

2. Fig. 431.



3. Fig. 432.



Cleavage, parallel with *d*, imperfect.

Lustre metallic. Color blackish lead-grey. Streak reddish grey. Opake.

Brittle. Scratches Fahlerz. Sp. gr. = 4·375 . . . 4·491.

Compound Varieties. Twin-crystals: axis of revolution perpendicular, face of composition parallel to a face of the octahedron; the individuals are continued beyond the face of compos-

tion.* Massive, composition granular . . . impalpable. Fracture uneven.

1. Before the blow-pipe, it decrepitates a little, and burns with a blue flame, emitting copious arsenical vapors, and melting at last into a black scoria, which affects the magnetic needle.

2. *Analysis.*

By R. PHILLIPS.

Copper	45·32
Arsenic	11·84
Iron	9·26
Sulphur	28·74
Silica	5·00

3. It occurs in several of the Cornish copper mines, in veins traversing granite and clay-slate; and is accompanied by several ores of copper.

4. It is probable that Tennantite, which was formerly included under Fahlerz, will prove to be a distinct species. Its inferior specific gravity, and greater hardness, are favorable to this idea.

TEPHROITE.

Massive: composition granular, of various sizes of individuals. Cleavage, parallel with the sides of a prism, but indistinct; with the faces of an octahedron, only in traces. Fracture even to subconchoidal.

Lustre adamantine. Color ash-grey, dark liver-brown to black. Streak pale ash-grey.

Hardness = 5·00. Sp. gr. = 4·104 . . . 4·116.

1. Fusible before the blow-pipe into a black scoria.

2. Its locality is given as Sparta, (N.J.) where it is said to occur along with Franklinite.

3. It appears to be a variety of Troostite.

TESSELITE. (See *Apophyllite.*)

TESSERAL-PYRITES.

Massive. Cleavage, parallel with the faces of a cube, distinct; with the faces of the dodecahedron only in traces.

* The existence of the regular composition is most easily ascertained by the striæ upon the faces of the cube, which are parallel to the edges of combination with one of the tetrahedrons.

Color tin-white.

Hardness (scale of BREITHAUPT) = 7·25 . . . 7·75. Sp. gr. = 6·74 . . . 6·84.

1. It occurs at Skutterud in Norway.

TETARTIN. (See *Albite.*)

TETRADYMITE.

Primary form. Rhomboid. P on P = 81° 2′.

Cleavage, perfect at right angles to the axis.

Color lead-grey.

In thin laminæ, somewhat flexible. Hardness = 1·50 . . . 2·0 Sp. gr. = 7·460 . . . 7·514.

Compound Varieties. Twin-crystals.

THENARDITE. Peritomous Brythine-Salt.

Primary form. Right rhombic prism. M on M = 125°.

Secondary form.

1. The primary, having the terminal edges deeply replaced; sometimes producing an octahedron with a rhombic base.

Cleavage, perfect parallel with the faces of the primary form; most distinct parallel with P.

Lustre vitreous. Color white. Transparent. After exposure to the light, it becomes coated with a white powder.

Sp. gr. = 2·73.

1. It is wholly soluble in water.

2. *Analysis.*

By CORDIER.

Sulphate of soda	99·78
Sub-carbonate of soda	0·22

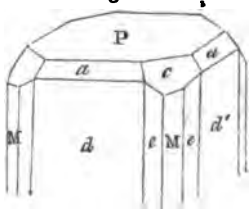
3. It occurs five leagues from Madrid, and two and a half leagues from Aranjues in Spain, at a place called Salines d'Espartines. It is deposited by evaporation, every summer, from a lake which holds it in solution.

THOMSONITE. Orthotomous Kouphone-Spar.

Primary form. Right square prism.

Secondary form.

Fig. 433.



M on *d* - - - -	135°	00′
P on *a* - - - -	134	38
P on *c* - - - -	125	00

Cleavage, perfect parallel with M, with P only in traces. Fracture uneven. Surface smooth.

Lustre vitreous, much inclining to pearly. Color white. Transparent . . . translucent.

Brittle. Hardness=5·0. Sp. gr.=2·37.

Compound Varieties. Massive: composition columnar, radiating from common centres.

1. It intumesces before the blow-pipe, and becomes snow-white and opake, but does not melt.

2. *Analysis.*

	By Thomson.	By Berzelius.
Silica	38·80	38·30
Alumina	31·36	30·20
Lime	15·40	13·54
Soda	0·00	4·53
Magnesia	0·20	0·40
Peroxide of iron	0·60	0·00
Water	13·00	13·10

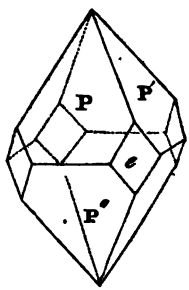
3. It is found with Analcime in the trap rocks of Kilpatrick, near Dumbarton in Scotland.

THORITE. Peritomous Tungstic-Baryte.

Primary form. Octahedron with a square base? P on P=120′.

Secondary form.

Fig. 434.



Cleavage, parallel with *e*, imperfect. Fracture uneven and splintery.

Lustre resinous. Color brown. Streak yellowish grey to brown.

Hardness=5·0 . . . 5·50. Sp. gr.=4·5 . . . 4·6.

1. Alone, before the blow-pipe, it is infusible, but becomes pale. It melts slowly with borax into a colorless glass.

2. *Analysis.*

Thorina	57·41
Lime	2·58
Oxide of iron	3·40
Oxide of manganese	2·39
Magnesia	0·36
Oxide of uranium	1·61
Oxide of lead	0·80
Oxide of tin	0·01
Silica	18·98
Water	9·50
Potash	0·14
Soda	0·10
Alumina	0·06
Powder not examined	1·76

Tin-Ore.

It was found in sienite, in the isle of Lövön, near Brevig in Norway; but is now no longer to be obtained.

THRAULITE. (See *Hisingerite.*)

THULITE.

Cleavage, parallel to the sides of a rhombic prism, of 92° 30′.

Color rose-red. Streak greyish white.

Scratched by Quartz, and yielding to the knife with difficulty.

1. It occurs at Tellemarken in Norway with Quartz, Fluor and Idocrase.

THURINGITE.

Massive: composition lamellar, and granular.

Cleavage, in one direction perfect.

Lustre pearly. Color olive-green. Streak siskin-green, and shining with a resinous lustre.

Greasy to the feel. Hardness (scale of BREITHAUPT) = 2·5 ... 3·0. Sp. gr. = 3·151 ... 3·157.

1. Found at Schmiedefeld in Saalfeld.

TILE-ORE. (See *Red Copper-Ore.*)

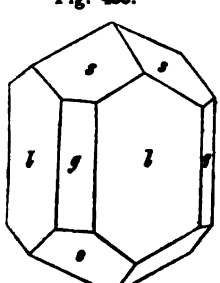
TINDER-ORE. (See *Red Antimony.*)

TIN-ORE. Peritomous Baryte-Ore.

Primary form. Octahedron with a square base. P on P″ = 67° 50′. P on P′ = 133° 30′.

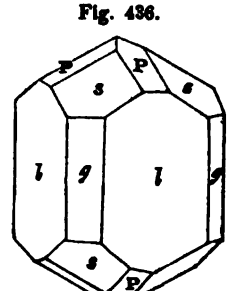
Secondary forms.

Fig. 435.



Cornwall.

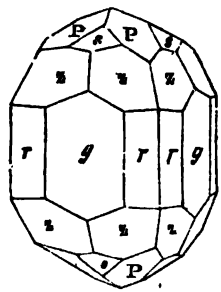
Fig. 436.



Goshen, (Mass.)

Tin-Ore.

Fig. 487.



Cornwall.

s on *s*	-	-	-	-	121°	35′
s on *s* over *g*		-	-	-	87	17
z on *z*	-	-	159°	6′ and	118	16
z on *z* over *r*		-	-	-	135	17
r on *r*	-	-	112°	27′ and	157	23

Cleavage, *s* and *g* not very distinct, traces of P. Fracture imperfectly conchoidal, uneven.

Surface, *g* often uneven, *s* sometimes irregularly striated parallel to the edges of combination with P, and the latter pyramid parallel to those with *s*. The prisms are sometimes vertically streaked.

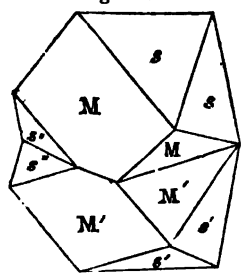
Lustre adamantine. Color various shades of white, grey, yellow, red, brown, black. Streak pale grey; in some varieties, it is pale brown. Semi-transparent, sometimes almost transparent... nearly opake.

Brittle. Hardness = 6·0...7·0. Sp. gr. = 6·960, a crystallized variety; =6·514, thin columnar composition; =7·100, from Cornwall.

Compound Varieties. Twin-crystals: axis of revolution perpendicular, face of composition parallel to one of the faces of P.

Tin-Ore.

Fig. 438.



Small reniform, rarely botryoidal shapes: composition very thin columnar, divergent from common centres, strongly connected, and often forming a second curved lamellar composition. Massive: composition granular, sometimes almost impalpable, strongly connected, fracture uneven. The hardness of very thin columnar compositions is often found as low as 5·5, owing to the delicacy of the individuals in this composition.

1. The *Wood-Tin* of the Cornish miners is only a variety of Tin-Ore, in the same manner as Red Hematite is of Specular Iron.

2. When heated in the platina forceps before the blow-pipe, it is unalterable. Upon charcoal, in a strong heat, it is reduced to the metallic state. The reduction is promoted by the addition of carbonate of soda. It is not attacked by acids. Fused with caustic potash, it yields a mass, which is mostly soluble in water. Muriatic acid, added to the solution, occasions a white precipitate, which is again dissolved. Hydriodic acid produces a yellow precipitate.

3. *Analysis.*

	By Klaproth. Crystallized var.	By Descotils. Compound var.
Oxide of tin	99·00	95·00
Oxide of iron	0·25	5·00
Silica	0·75	0·00

4. Tin-Ore occurs disseminated in rocks, particularly in granite; also in beds and veins. It is frequently accompanied by Wolfram and Molyb-

denite. It occurs in pebbles and is extracted, in this shape from stream-works. The variety wood-tin has only been met with in these repositories.

5. Its principal deposits are in Saxony, Cornwall and Bohemia. It is found in considerable abundance, both on the Bohemian and Saxon sides of the Erzgebirge, disseminated in granite and in beds alternating with it; particular localities in this region, are Schlaggenwald, Altenberg, Gezer, Ehrenfriedersdorf, Marienberg. Twin-crystals abound at Schlaggenwald. In Cornwall, it exists in veins traversing granite and schist, and is accompanied by green Talc, (var. Chlorite,) Fluor, Quartz, Topaz, Tourmaline, Mispickel, Wolfram and Blende. At St. Michael's Mount, it is disseminated through granite. The ore is chiefly in the state of single crystals. Stream-works exist both in Cornwall and Saxony. It is found in Galicia, Spain, in mica-slate, in the granite hill of Puy des Vignes, Haute Vienne, in France, and in the mountain chains of Fichtel and Riesengebürge in Germany. Other localities are in Asia, on the east coast of Sumatra, Siam and Pegu; also at Banca and Malacca, and in Mexico and Chili. A few black crystals have been found with Tourmaline in Albite, at Goshen, (Mass.)

TIN-PYRITES. Hexahedral Copper-Glance.

Primary form. Cube.

Massive: composition granular, strongly coherent. Fracture uneven, imperfectly conchoidal.

Lustre metallic. Color steel-grey, inclining to yellow. Streak black. Opake.

Brittle. Hardness = 4·0. Sp. gr. = 4·479 . . . 4·515.

1. Heated in an open tube, it gives the smell of sulphurous acid. On charcoal before the blow-pipe, it melts, depositing at the same time a white powder, which is not volatile and consists of oxide of tin, a brittle globule remaining behind. On moistening the mass with muriatic acid, and exposing it to the flame of a lamp, it colors it of a beautiful blue. The mineral being treated with fluxes, gives the reactions of copper and iron. It is soluble in nitro-muriatic acid, during which the sulphur is precipitated. 2. *Analysis.*

By Klaproth.

Sulphur	20·85	25·00
Tin	38·11	34·00
Copper	41·04	39·00
Iron	0·00	2·00

Topaz.

3. It is found near St. Agnes in Cornwall, and at Zinnwald in Saxony.

TITANITE. (See *Sphene.*)

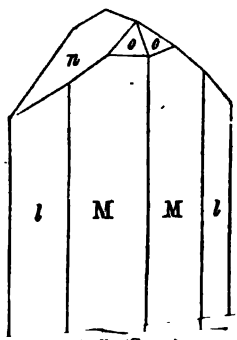
TITANITIC IRON. (See *Crichtonite.*)

TOPAZ. Prismatic Topaz. MOHS.

Primary form. Right rhombic prism. M on M=124° 19′.

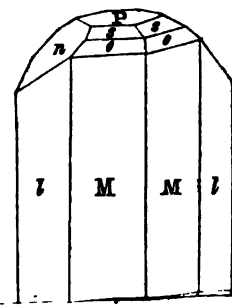
Secondary forms.

Fig. 439.



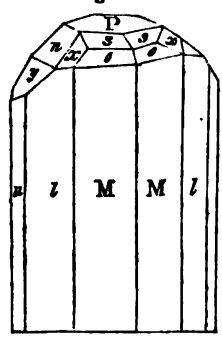
Trumbull, (Conn.)

Fig. 440.



Trumbull, (Conn.)

Fig. 441.

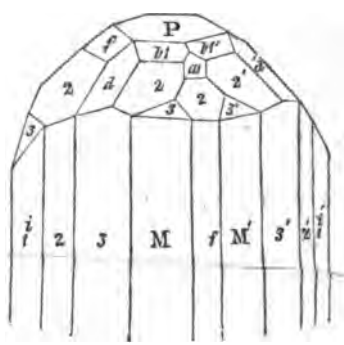


Trumbull, (Conn.)

Topaz.

M on *l*	-	-	161°	16′	Hauy.
M on *o*	-	-	135	59	"
l on *l*	-	-	93	6	"
M on *u*	-	-	150	6	"
n on *n*	-	-	91	58	"
o on *o*	-	-	140	46	"
o on *s*	-	-	168	37	"
P on *o*	-	-	134	1	"
P on *n*	-	-	135	59	"
P on *x*	-	-	138	26	"
P on *u*	-	-	117	21	"

Fig. 442.



P on *b*1	-	124°	36′	P.	P on *b*2	-	134°	1′	P.
P on *b*2	-	135	59	"	*b*2 on *b*2	-	140	46	"
M on *i*1	-	150	6	"	*b*2 on *b*3	-	162	00	"
M on *i*2	-	161	16	"	*b*3 on *i*2	-	148	22	"
M on *i*3	-	169	34	"	*a*1 on *f*	-	134	00	"
P on *c*1	-	128	26	H.	*f* on *i*2	-	122	17	H.
P on *c*2	-	135	59	P.	*c*2 on *c*2, over P		92	45	P.
P on *c*3	-	117	21	"	*d* on *i*2	-	131	34	H.
P on *d*	-	138	26	"	*b*3 on *a*2	-	155	30	P.
P on *b*1	-	145	24	"					

Topaz.

Cleavage; parallel with P highly perfect; with *n* imperfect; traces of M and *l*. Fracture more or less perfectly small conchoidal, uneven. Surface, P rough, sometimes faintly striated, parallel to the edges of combination with *l*. The vertical planes always striated, sometimes deeply, parallel to their common edges of combination. The pyramidal planes always smooth.

Lustre vitreous. Color, white, yellow, green, blue, various, but generally pale shades. Streak white. Transparent... translucent, sometimes only on the edges.

Hardness = 8·0. Sp. gr. = 3·499, of a transparent crystallized variety; = 3·494 variety Pycnite.

Compound Varieties. Massive: composition granular, of various sizes of individuals; faces of composition rough. There occurs also columnar composition, the individuals being thin, long and parallel, and easily separated, and their faces of composition longitudinally streaked.

1. Two varieties of Topaz have been treated of by many writers as distinct species: viz. the *Physalite* and *Pycnite*. The first of these consists of imbedded crystals, whose surface is rough and uneven, or large massive individuals, whose color is a pale greenish grey. The latter occurs in thin and straight columnar particles of composition, forming larger or smaller imbedded masses, and not possessing bright colors or high degrees of transparency.

2. In a strong heat, the faces of crystallization, but not those of cleavage, are covered with small blisters, which however, immediately crack. With borax, it melts slowly into a transparent glass. Its powder colors the tincture of violets green. Those crystals which possess different faces of crystallization on opposite ends, acquire different kinds of electricity on being heated. By friction, it acquires positive electricity.

Topaz.

3. *Analysis.*

By BERZELIUS.

	Crystals.	Physalite.	Pycnite.
Alumina	57·45	57·74	51·00
Silica	34·24	34·36	38·43
Fluoric acid	7·75	7·77	8·84

4. Topaz enters into the composition of granitic rocks; thus it forms with Quartz and Tourmaline the Topaz-rock of Saxony. It occurs also in irregular beds, either with Quartz and Mica, like the variety Pycnite; or with Feldspar, Quartz, Beryl, &c. like the Physalite. It is also found in veins, traversing gneiss, where it is associated with Fluor, Mica and Wolfram, as at Trumbull, (Conn.) It is met with besides in tin stream-works, and in the alluvial deposits of rivers along with other gems.

5. The most perfect crystals are found with Beryl in the Uralian and Altai mountains, and in Kamtschatka; in Brazil, where they are met with in loose crystals, and at Mucla in Asia Minor. They occur in the Topaz-rock at Danneberb in Saxony, and at Ehrenfriedersdorf and Zinnwald associated with Tin-ore; in similar repositories at Schlaggenwald in Bohemia and St. Michaels mount in Cornwall; with Lepedolite near Rozena in Moravia. Physalite is found at Finbo and Broddbo near Fahlun in Sweden. Pycnite at Altenberg in Saxony. Topaz pebbles are found in the stream-works of Eubenstock in Saxony, in the granitic districts of Cairngorm in Aberdeenshire, and in New South Wales.

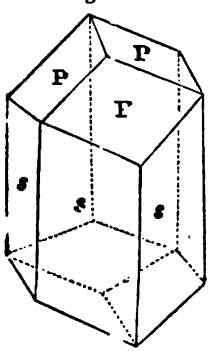
But a single locality is known in the United States, which exists at Trumbull, (Conn.) in a vein upwards of one foot in width, where it is associated with Fluor, Magnetic Pyrites, Mica, and rarely with Wolfram and Tungsten. The Topaz is chiefly white, but when imbedded in the magnetic Pyrites its color is green. It presents small druses occuring in the veins, lined with tolerably perfect crystals, which are white and transparent. Occasionally the crystals are several inches in diameter, and perfect in some of their planes, but they are generally deficient in transparency and lustre. Rarely, the massive individuals and imperfect crystals are six or eight inches in diameter.

6. It is much used as an ornamental stone. The blue varieties are called *Oriental Aquamarine*, by Lapidaries. If exposed to heat, the Topaz from Saxony loses its color and becomes white; the deep yellow Brazilian varieties assume a pale pink color, and are then sometimes mistaken for Spinel, or Ballas-ruby.

TOPAZOLITE. (See *Garnet.*)
TORRELITE. (See *Quartz.*)

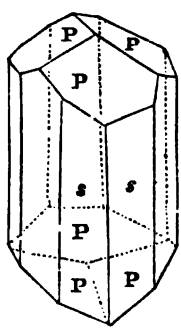
TOURMALINE. Rhombohedral Tourmaline.
Primary form. Rhomboid. P on P=133° 26′.
Secondary forms.

Fig. 443.



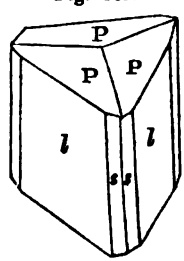
(Brown.)
Monroe, (Conn.)

Fig. 444.



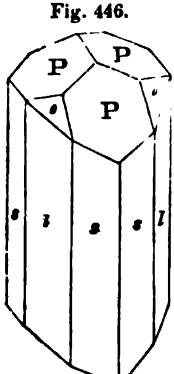
(Brown.)
Monroe, (Conn.)

Fig. 445.



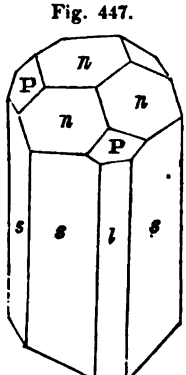
(Black.)
Haddam, (Conn.)

Fig. 446.



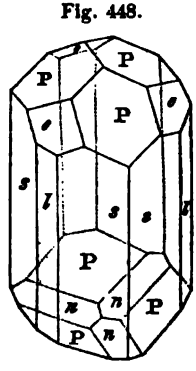
(Black.)
Brunswick, (Me.)

Fig. 447.



(Black.)
Brunswick, (Me.)—Monroe, (Conn.)

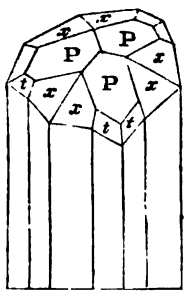
Fig. 448.



(Cinnamon-red.)
Newton, (N. J.)—Governeur, (N. Y.)

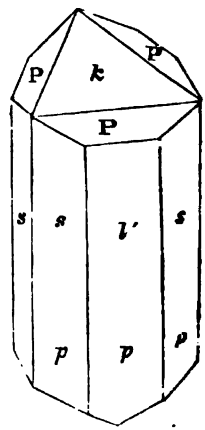
Tourmaline.

Fig. 449.



(Green.)
Paris, (Me.)

Fig. 450.



(Green, red and white.)
Chesterfield, (Mass.)—
Paris, (Me.)

P on *s*	-	-	113°	13′	HAUY.
P on *l*	-	-	117	9	"
s on *l*	-	-	150	00	"
P on *o*	-	-	141	40	"
o on *l*	-	-	135	44	"
P on *n*	-	-	156	43	"
n on *n*	-	-	155	9	"
n on *s*	-	-	102	26	"
P on *x*	-	-	158	25	"
P on *t*	-	-	151	5	"
x on *x*	-	-	136	50	"
t on *t*	-	-	149	26	"
P on *k*	-	-	152	51	"

Cleavage, parallel with P and *s* difficult. Fracture imperfectly conchoidal, uneven. Surface, the prisms deep-

ly striated, parallel to the axis; *k* rough, the rest of the faces generally smooth, and of nearly the same physical quality.

Lustre vitreous. Color, brown, green, blue, red, white, frequently black; generally dark colors, rarely bright. Streak white. Transparent... almost opake, agreeably to the color. Less transparent if viewed in a direction parallel to the axis than when perpendicular to it, and generally different colors in these directions.

Hardness = 7·0 ... 7·5. Sp. gr. = 3·076; = 3·021, transparent Rubellite from Paris; =3·009, of a transparent green variety from Paris; =3·055 of transparent Indicolite from Paris.

Compound Varieties. Massive: composition seldom granular, of various sizes of individuals; generally columnar, of various sizes of individuals, often very thin, straight and parallel or divergent; sometimes again aggregated into larger granular, or wedge-shaped masses; faces of composition smooth and longitudinally streaked.

1. *Tourmaline* and *Schorl* were formerly distinguished as two particular species, though they differ in no other respects than in color and transparency. Tourmaline included the green, blue, red, brown and white color, (the blue being called *Indicolite* and the red *Rubellite*), while Schorl comprised the black varieties.

2. This species offers a variety of results when heated before the blow-pipe. Some varieties (especially those containing lithia) intumesce and assume a slaggy appearance, but do not melt; others (which contain lime) intumesce still more and melt into a white slag. It assumes by heat, opposite kinds of electricity on the opposite ends of the crystals. The finest, transparent crystals, especially when cut by the lapidary, are constantly electric without artificial heat.

3. *Analysis.*

By GMELIN.

Varieties and localities.			Boracic acid.	Silica.	Alumina.	Protoxide of iron.	Oxide of manganese.	Lime.	Potash.	Soda.	Lithia.	Magnesia.	Loss by heat.
Red Tourmaline.	Rozna.	Sp. gr.=2·960 ...3·020.	5·74	42·13	36·43	0 00	6·32	1·20	2·41	0·00	2 04	0·00	1·31
Red Tourmaline.	Perme, Siberia.	Sp. gr.=3·059 ...3·100.	4·18	39·37	44 00	0 00	5 02	0 00	1·29	0·00	2·53	0·00	1·58
Celandine-green.	Brazil.	Sp. gr.=3·079.	4·59	39·16	40·00	5·96	2·14	0·00	0·00	0·00	3·59 with pot.	0·00	1·58
Black.	Devonshire.	Sp. gr.=3·246.	4·11	35·20	35·50	17·86	0·43	0·55	0·00	2·09	0·00	0·70	0·00
Black.	Eibenstock, Saxony.	Sp. gr.=3·123.	1·69	33·05	38·23	23·86	0·00	0·86	0·00	3·17	0·00	0·00	0·45
Green.	Chesterfield, (Mass.)	Sp. gr.=3·102.	3·88	33·80	39·61	7·43	2·88	0·00	0·00	4 95	0·00	0·00	0·78
Black.	Sweden.	Sp. gr.=3·044.	3·83	37·65	33·46	9·38	0·00	0·25	2·53 and soda.	0·00	0·00	10·98	0·03
Black.	Bavaria.	Sp. gr.=3·113.	4·02	35·48	34·75	17·44	1·89	traces.	0·48	1·75	0·00	4·68	0·00
Black.	Greenland.	Sp. gr.=3·062.	3·63	38·79	37·19	5·81	traces.	0·00	0·22	3·13	0·00	5·86	1·86
Brown.	St. Gothard.		4·18	37·81	31·61	7·77	1·11	0·98	1·20 and soda.	0·00	0·00	5·99	0·24

Tourmaline.

4. Tourmaline is frequently met with in rocks, particularly in granite, but without forming a regular ingredient of any, and is found imbedded in them in larger or smaller masses, or crystallized in the drusy cavities, as in the Topaz-rock of Saxony and the granite of Paris, (Me.) The dark brown variety of Monroe, (Conn.) forms with Mica a bed in mica-slate. The cinnamon-red occurs disseminated through dolomite and granular limestone; and the green and red varieties with smoky Quartz form a vein embraced on each side by Albite, traversing granite at Chesterfield, (Mass.) It is also met with in the shape of pebbles, in the stream-works, and in the sand of many rivers.

5. Some of the most remarkable among the foreign localities of Tourmaline are the following; black crystals in Greenland, in the mountains called Hörlberg near Bodenmais in Bavaria, and near Bovey in Devonshire, England; red varieties from Perme in Siberia, Rozěna in Moravia; pale green with a tinge of yellow at St. Gothard in dolomite, and green and blue varieties from Brazil and Ceylon, where they are found in the sand of rivers.

The United States is particularly rich in Tourmaline. Paris, (Me.) has thus far yielded the most remarkable crystals for size, color and transparency, and which were found loose in the soil, covering a decomposing ledge of graphic granite. Some of these were upwards of an inch in diameter, transparent, red at one end and green at the other. The granite still continues to afford blue and pink crystals and compound varieties, which are mostly imbedded in Lepidolite; also long slender green crystals and columnar aggregations traversing large individuals of brown Mica. The vein of Tourmalines of Chesterfield, (Mass.) is about one foot in width. The crystals are small, rarely perfect in form, deeply striated, often much curved, and rifted by cross seams into which the Quartz is thrust. The green crystals especially those situated in the smoky Quartz, often contain in their centres prisms of Rubellite, while the single crystals of Tourmaline which have shot into the Albite, are frequently pure red or green. Similar varieties are found at Goshen, where the interior of the crystals is sometimes blue or green, and the exterior a pale rose-color, or some different shade of green or blue. The deep indigo-blue varieties, particularly, abound at Goshen. Monroe, (Conn.) furnishes the most perfect crystals in form, found in the United States. They are of a dark yellowish brown color, and translucent only on their edges. They vary in size from a hazle-nut to two or three inches in length, and one or two in diameter, being universally

perfect at both extremities. A cinnamon-red, and brown variety occurs at Governeur, St. Lawrence co., (N. Y.) in granular limestone with Scapolite, Pyroxene and Apatite, though it is chiefly imbedded by itself in veins of white Quartz. A similar variety is found at Grenville, Lower Canada, Newton, (N. J.) with Corundum, Spinel and Rutile, at Kingsbridge, (N. Y.) and at Carlisle, (Mass.) with Garnet. Black varieties are found at numerous places. The most beautiful have been obtained from Brunswick, (Me.), Monroe and Haddam, (Conn.) and Greenfield, (N. Y.)

6. The red varieties of Tourmaline are highly esteemed in jewellery; when they are transparent and of a fine color, they rank on a level with the oriental ruby. The green and blue varieties are also cut when their color is not too intense.

TREMOLITE. (See *Hornblende.*)

TRICLASITE. (See *Fahlunite.*)

TRIPLITE. Prismatic Parachrose-Baryte.

Massive: cleavage in three directions perpendicular to each other, one of them more distinct. Fracture small conchoidal.

Lustre resinous, inclining to adamantine. Color blackish-brown. Streak yellowish-grey. Translucent on the edges. Opake.

Brittle. Hardness = 5·0 ... 5·5. Sp. gr. = 3·439 ... 3·775.

1. Before the blow-pipe, it melts easily into a black scoria, and is readily dissolved in nitric acid without effervescence.

2. *Analysis.*

By VAUQUELIN.

Oxide of iron - - - - - - -	31·00
Oxide of manganese - - - - - - -	42·00
Phosphoric acid - - - - - - -	27·00

3. It has been found near Limoges in France, in a vein of Quartz in granite, accompanied by Apatite. In the United States, it occurs in considerable quantity at Washington, (Conn.) where it exists as at Limoges

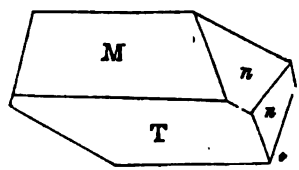
in France, but is associated with pulverulent Diallogite. In small quantity, also, at Sterling, (Mass.) along with Spodumene.

TRONA. Tetarto-prismatic Natron-Salt.

Primary form. Doubly oblique prism. M on T = 103° 15′.

Secondary form.

Fig. 451.



T on *n* - - - -	103°	15′
n on *n* - - - -	132	30

Cleavage, perfect parallel to M. Fracture uneven. Surface, M and *n* smooth, T streaked.

Lustre vitreous. Color white, sometimes passing to yellowish-grey. Streak white. Transparent... translucent. Rather brittle. Hardness = 2·5...3·0. Sp. gr. = 2·11. Taste, sharply alcaline.

1. It does net deliquesce in the air.

2. *Analysis.*

Carbonic acid - - - - - - - -	40·24
Soda - - - - - - - -	37·93
Water - - - - - - - -	21·83

3. It is found at Fezzan in Tripoli, where it occurs mingled with the soil and dissolved in water.

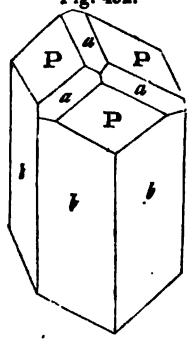
TROOSTITE. Rhombohedral Parachrose-Baryte.

Primary form. Rhomboid. P on P = 115° (c. g.)

Troostite.

Secondary form.

Fig. 452.



P on *a* - - -	147°	30′	c. g.
P on *b* - - -	122	00	"
a on *b* - - -	109	00	"
b on *b* - - -	120	00	"

Irregular forms, grains.

Cleavage parallel with *b* perfect, at right angles to the axis less distinct, with P in traces. Surface, *b* smooth and shining, P and *a* dull. Fracture conchoidal.

Lustre vitreous, inclining to resinous. Color pale asparagus-green, yellow, grey, and reddish-brown; none of them bright. Transparent to translucent.

Brittle. Hardness = 5·5. Sp. gr. = 4·0 . . . 4·1.

Compound Varieties. Massive: composition granular.

1. Heated before the blow-pipe, it becomes transparent and melts on the edges. With borax, it dissolves giving the violet tinge of oxide of manganese. It is dissolved with effervescence in muriatic acid, at the same time giving out chlorine, and leaving a residue of silica.

2. *Analysis.*

By Thomson.

Silica - - - - - -	30·650
Protoxide of manganese - - - - -	46·215
Peroxide of iron - - - - - -	15·450
Loss by heat - - - - - -	7·300

Tungsten.

3. It is found at Sterling, (N. J.) associated with Franklinite. Its crystals are sometimes above an inch in length.

TUNGSTATE OF IRON. (See *Wolfram.*)

TUNGSTATE OF LEAD. (See *Scheeletine.*)

TUNGSTATE OF LIME. (See *Tungsten.*)

TUNGSTEN. Pyramidal Tungstic-Baryte.

Primary form. Octahedron with a square base P on P over the base = 130° 20′, over the pyramidal edge = 100° 8′.

Secondary forms.

Fig. 453.

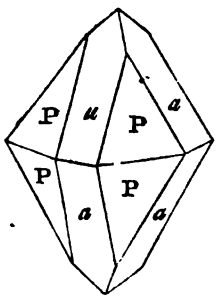
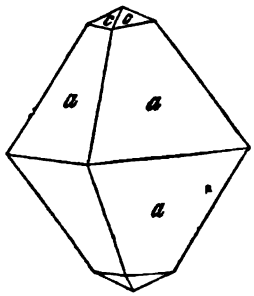


Fig. 454.



Trumbull and Monroe, (Conn.)

Cleavage, parallel with P and *a*; more splendent in the direction of the former, though more interrupted by small conchoidal fracture. Fracture imperfectly conchoidal, uneven. Surface, *a* irregularly streaked, sometimes concave, P and the other faces are generally smooth.

Lustre vitreous, inclining to adamantine. Color generally white, often inclining and passing into yellowish-grey, yellowish and reddish brown, sometimes almost orange-yellow. Streak white. Semi-transparent . . . translucent.

Brittle. Hardness = 4·0 ... 4·5. Sp. gr. = 6·076, a white cleavable variety from Schlaggenwald.

Compound Varieties. Twin-crystals. Axis of revolution perpendicular, face of composition parallel to faces truncating the base of the octahedron, *a*. The individuals are continued beyond the face of composition. Reniform shapes; surface drusy, composition columnar. Massive: composition granular, faces of composition sometimes irregularly streaked.

1. Heated upon charcoal, it decrepitates at first, and then fuses, but only with great difficulty and on the thinnest edges into a semi-transparent, vitrified mass. It gives a white glass with borax, the transparency of which is proportioned to the quantity of the salt employed.

2. *Analysis.*
By Berzelius.

Lime	19·40
Tungstic acid	80·42

3. Tungsten occurs mostly in the repositories of Tin-Ore, and is accompanied by Wolfram, Topaz, Fluor and Quartz. It is also found in lead veins with Wolfram and Spathic Iron.

4. Its most remarkable localities are Schlackenwald and Zinnwald in Bohemia, Zinnwald and Ehrenfriedersdorf in Saxony, and Cornwall, England. It is also found in Sweden and Dauphiny. It occurs in large irregular crystals and massive at Monroe, in Quartz with Wolfram, Galena, Native Bismuth and Tungstic-ochre; also in the adjoining town of Trumbull in a vein of Topaz, Quartz and Fluor.

TUNGSTIC OCHRE. Tungstic Lusine-Ore.

Massive: composition impalpable; earthy and pulverulent. Fracture earthy.

Color lemmon-yellow.

Soft. Sp. gr. = 6·0.

1. It assumes a greenish hue when strongly heated. It combines with the acids and is soluble in caustic alkalies.

2. It is probably tungstic acid in a state of perfect purity, and therefore consists of Oxygen 13·55. and Tungsten 86·45.

Turnerite.

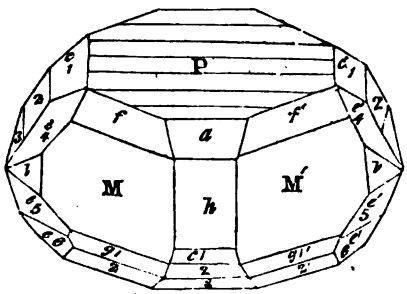
3. It is found associated with Wolfram and Tungsten at Lanes' mine in Monroe, (Conn.) usually in very thin coatings, rarely filling up small cavities.

TURNERITE.

Primary form. Oblique rhombic prism. M on M = 96° 10′. P on M = 99° 40′.

Secondary form.

Fig. 455.



P on *a*	-	-	142°	29′	LEVY.
P on *f*	-	-	133	50	PHILLIPS.
M on *a*	-	-	126	10	"
M on *g*1	-	-	140	50	LEVY.
M on *h*	-	-	138	5	"
M on *l*	-	-	161	2	"
P on *c*1	-	-	155	17	"
P on *c*2	-	-	139	25	PHILLIPS.

Cleavage parallel to both diagonals of the primary form, one of them more perfect.

Lustre nearly adamantine. Color several shades of yellow, often inclining to brown. Streak white, sometimes greyish. Transparent . . . translucent.

Scratches Fluor pretty readily, but yields to the knife.

1. According to the blow-pipe experiment of Mr. CHILDREN, it consists chiefly of alumina, lime, magnesia, and a little iron with traces of silica.

2. It is found at Mt. Sorel in Dauphiny, attended by Quartz, Feldspar, Albite, Crichtonite and Anatase.

TURQUOISE. Uncleavable Azure-Spar.

Massive: composition impalpable. Fracture conchoidal. Color blue . . . green, rather bright. Streak uncolored. Feebly translucent on the edges . . . opake.

Hardness = 6·0. Sp. gr. =2·83 . . . 3·00. FISCHER.

1. It is not dissolved by muriatic acid. Before the blow-pipe, it becomes brown in the reducing flame, and gives a green color to it. It is infusible by itself, but melts easily with borax or salt of phosphorus.

2. According to BERZELIUS, it consists of phosphate of alumina and lime, silica, oxide of iron and copper, and a little water.

3. It is found in Persia, either in pebbles, or in small veins, traversing a kind of trap.

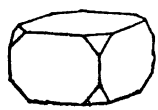
4. Cut and polished, it is used for different ornamental purposes.

URANITE. Pyramidal Euchlore-Mica. MOHS.

Primary form. Right square prism.

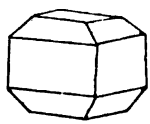
Secondary forms.

Fig. 456.



Cornwall.

Fig. 457.

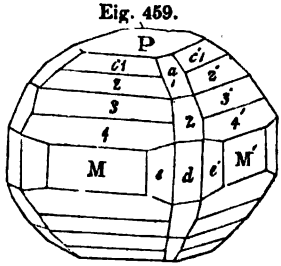


Cornwall.

Fig. 458.

Cornwall.

Fig. 459.



Uranite.

P on *c*1 - -	145°	32′	PHILLIPS.
P on *c*2 - -	140	40	"
P on *c*3 - -	137	10	"
P on *c*4 - -	111	50	"
P on *a*2 - -	134	00	"
*c*4 on *c*4 - -	97	32	"

Cleavage, P highly perfect and easily obtained. Traces of *d*. Fracture not observable. Surface, P smooth, *c* horizontally streaked, M rough.

Lustre pearly upon P, both as faces of crystallization and of cleavage; adamantine upon the other faces. Color emerald-green, and grass-green, less frequently leek-green, apple-green, or siskin-green. Streak corresponding to the color, though paler. Transparent . . . translucent, sometimes only on the edges.

Sectile. Hardness = 2·0 . . . 2·5. Sp. gr. = 3·115.

Compound Varieties. Massive: composition granular, of various sizes, faces of composition rarely observable.

1. Alone before the blow-pipe, it turns yellow and loses its transparency. Upon charcoal, it intumesces a little, and melts into a black globule, with traces of crystallization upon the surface. With borax, it yields a yellowish green bead, and produces a yellow solution in nitric acid.

2. *Analysis.*

	By BERZELIUS.		By R. PHILLIPS.
	fr. Cornwall.	fr. Autun.	fr. Cornwall.
Phosphoric acid	14·62	14 96	16·00
Oxide of uranium	62·52	64·03	60·00
Oxide of copper	8·12	0·00	9 00
Water	14·74	15 04	14·50
Lime	0·00	5·97	0 00
Silica	0·00	0 00	0·50

3. Uranite is found in veins of copper, silver, tin and iron ores, and sometimes also in beds; and is generally accompanied by the other ores of uranium.

4. Beautiful varieties are found in Cornwall. It also occurs at Johanngeorgenstadt, Schneeberg, and Eubenstock; at St. Symphorien near Autun, and at St. Yrieix near Limoges in France.

URANIUM-OCHRE. Uranium Lusine-Ore.

Massive: composition impalpable; earthy and pulverulent.

Color, sulphur-yellow, citron yellow, to brownish or reddish yellow.

1. It affords moisture on being heated in a glass tube. It turns green in the reduction flame of the blow-pipe, without melting.

2. It is believed to be an oxide of uranium, though according to ZIPPE, the variety from Joachimsthal contains carbonic acid.

3. It is found accompanying the Pitchblende in Cornwall and in Bohemia.

URANIUM-ORE. (See *Pitchblende.*)

URANIUM-VITRIOL. (See *Johannite.*)

UWAROWITE.

Crystals small rhombic dodecahedrons.
Lustre vitreous.
Color emerald-green.
Hardness (scale of BREITHAUPT) = 10·0 and above.

1. Locality not mentioned.

VALENCIANITE. (See *Periklin.*)

VANADIATE OF LEAD. (See *Pyromorphite.*)

VARIEGATED COPPER. Octahedral Bronze-Pyrites.

Primary form. Regular octahedron.

Secondary forms.

1. Primary, having its angles truncated.
2. Regular octahedron. Cornwall.
3. Octahedron, with the angles truncated. Cornwall.

Cleavage, traces in the direction of the primary faces. Fracture small conchoidal, uneven. Surface generally

rough, particularly those of the cube, and often curved; much subject to tarnish.

Lustre metallic. Color intermediate between copper-red and pinchbeck-brown. Streak pale greyish-black, a little shining.

Rather sectile. Hardness=3·0. Sp. gr.=5·003, from the Bannat.

Compound Varieties. Twin-crystals; axis of revolution perpendicular, face of composition parallel to a face of the octahedron, the individuals being continued beyond the face of composition. Massive; composition granular, strongly connected; fracture conchoidal and uneven.

1. Before the blow-pipe, on charcoal, it melts into a globule, which becomes magnetic, if kept in the blast for some time.

2. *Analysis.*

By PHILLIPS.

Copper	61·07
Sulphur	23·75
Iron	14·00
Silica	0·50

3. It occurs in beds and veins; the crystallized varieties only in veins. It is accompanied chiefly by various other ores of copper.

4. It occurs at Orawitza and other places in the Bannat, associated with Garnet. It is found likewise in beds in the cupriferous shale of the Mansfeld, included in thin layers in the bituminous marl-slate. But it is particularly found in Cornwall, in the vicinity of Redruth. In smaller quantities, it is found in Ireland, Hessia, Silesia, Norway, Sweden, &c.

It has only been met with in a few places in the United States. Thin seams occur in granite, at Chesterfield, (Mass.), and in Pennsylvania, where it occurs under circumstances similar to those mentioned at Mansfield.

VARVICITE.

In radiating and twin-crystals. Cleavage prismatic.

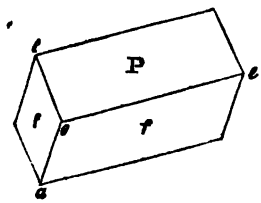
Lustre sub-metallic. Color iron-black to steel-grey. Streak black. Hardness (scale of BREITHAUPT) = 3·0 ... 3·75. Sp. gr. = 4·531, from Warwick; = 4·623, from the Hartz.

VAUQUELINITE. ——— Lead-Baryte.

Primary form. Oblique rhombic prism.

Minute crystals, nearly resembling the annexed figure,

Fig. 460.



if the obtuse edges *o a* be replaced, and the figure be compressed parallel with P, and joined in regular compositions, parallel to a plane, which passes through the crystals in the direction of *e e*, and intersects the acute lateral edges. Inclination of P on P′ from the other individual, nearly 134° 30′; of the edge *o a*, or its replacement on P, about 149°.

Fracture uneven. Surface, P smooth and even, the rest of the faces a little curved.

Lustre adamantine, often faint. Color blackish green, olive-green. Streak siskin-green, often inclining to brown. Faintly translucent, with a fine olive-green tint, opake.

Rather brittle. Hardness =2·5 . . . 3·0. Sp. gr.=5·5 . . . 5·78.

Compound Varieties. Botryoidal, reniform, massive: composition generally impalpable, surface drusy or rough, fracture imperfect and flat conchoidal, lustre faintly resinous.

1. Alone, before the blow-pipe, it intumesces a little, and then froths and melts into a greyish globule, giving at the same time some globules of lead. In the oxidating flame, a small quantity effervesces with, and imparts a green color to, borax and salt of phosphorus, which remains transparent on cooling; but in the reducing flame, the globule turns red and transparent, or red and opake, or finally black, according to the quantity of the mineral employed.

2. *Analysis.*

Oxide of lead	60·87
Oxide of copper	10·80
Chromic acid	28·33

3. It occurs at Beresof in Siberia, along with Red Lead-Ore and Pyromorphite, and is said to be found in Brazil.

Velvet-Blue Copper.

Short capillary crystals, in velvety druses and coatings.

Lustre pearly. Color bright smalt-blue. Translucent.

1. It has been found lining drusy cavities in Limonite, at Moldawa in the Bannat of Temeswar.

Vignite.

Massive: composition granular.

Color dark greenish blue.

Sp. gr. = 3·71. It is magnetic.

2. *Analysis.*

By Karsten.

Oxide of iron	49·14
Protoxide of iron	35·30
Carbonic acid	11 06
Phosphoric acid	4·50

2. It is found in Jura limestone, at Vignes.

3. It appears to belong to the species Magnetic-Iron.

VITREOUS COPPER. Prismatic Copper-Glance. Mohs.

Primary form. Right rhombic prism. M on M = 119° 35′.

Secondary forms.

Fig. 461.

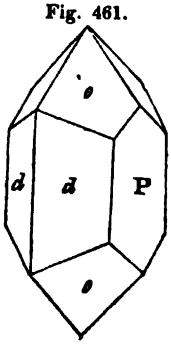
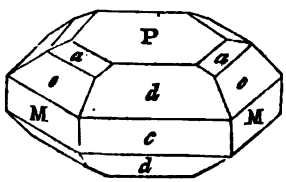


Fig. 462.



Vitreous Copper.

o on *o* - - -	126°	52′
d on *d* - - -	63	00
o on *o* over *d* - -	80	6

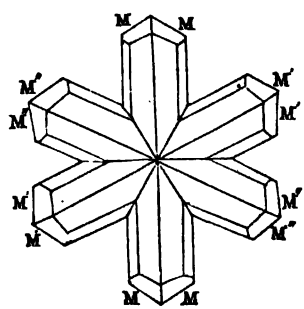
Cleavage, traces of M, very imperfect. Fracture conchoidal. Surface, most of the faces smooth, only the faces at right angles to the axis, and particularly *c*, are streaked horizontally.

Lustre metallic. Color blackish lead grey. Streak unchanged, sometimes shining.

Very sectile. Hardness = 2·5 . . . 3·0. Sp. gr. = 5·695, the compact variety from Bannat.

Compound Varieties. Twin-crystals: 1. Axis of revolution perpendicular to one or both faces of M; face of

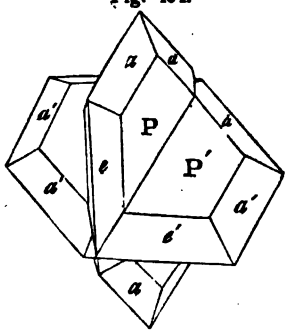
Fig. 463.



composition parallel to it, as in the accompanying figure, only that the re-entering angles are filled up. 2. Axis of revolution perpendicular, face of composition parallel to a face of *a*; the individuals being continued beyond the face of composition.

Vitreous Copper.

Fig. 464.



The inclination of P to P′ is equal to that of the acute terminal edge of *a* on *a′* on one side, and of 91° 51′ on the other; the respective inclinations of *a* on *a′* are =153° 37′, and = 157° 19′. Massive; composition granular, of various sizes of individuals, generally small, and often impalpable; in the last case the fracture becomes uneven, even or flat conchoidal. Plates.

1. In the oxidating flame of the blow-pipe, it melts and emits glowing globules, attended with some noise. In the reducing flame, it becomes covered with a coat, and does not melt. When the sulphur is driven off, a globule of copper remains. If the mineral be treated with nitric acid, the copper is dissolved, forming a green solution; but the sulphur remains undissolved.

2. *Analysis.*

	By Klaproth.	By Ullmann.
Sulphur	18·50	19·00
Copper	78·50	79·50
Iron	2·25	0·75
Silica	0·75	1·00

3. It occurs abundantly in beds and veins, and is accompanied by other ores of copper, by Iron-Pyrites and Quartz.

4. Large and well defined crystals occur in several mines near Redruth in Cornwall. Compound varieties, and rarely distinct crystals, are found in beds in the Bannat of Temeswar, near Catherinenburg in Sibe-

ria, in Mansfield, in Hessia, &c. A foliated variety is found in Cornwall, in the Bannat, in Siegen, and in Mansfeld.

Compact varieties are found at Schuyler's mines, New Jersey, in the old red sandstone, and in the same rock in Connecticut, at Simsbury and Cheshire.

VITREOUS SILVER. Dodecahedral Polybasic-Glance.

Primary form. Cube.

Secondary forms.

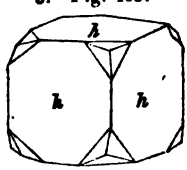
1.
Cube, with angles truncated.
Freiberg.

2.
Regular octahedron.
Joachimsthal.

3.
Cube, with edges truncated.

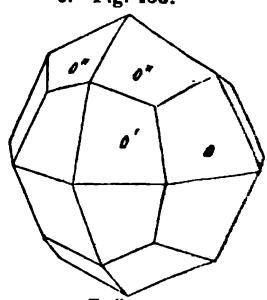
4.
Rhombic dodecahedron.

5. Fig. 465.



Freiberg.

6. Fig. 466.



Freiberg.

Cleavage, sometimes traces parallel to the rhombic dodecahedron. Fracture imperfect and small conchoidal, uneven. Surface, nearly of the same description in all the forms, often uneven, and possessing low degrees of lustre. Subject to tarnish.

Lustre metallic. Color blackish lead-grey. Streak shining.

Malleable. Hardness = 2·0 . . . 2·5. Sp. gr. = 7·196 . . . 7·366.

Compound Varieties. Reticulated, arborescent, dentiform, filiform, and capillary shapes: individuals sometimes distinguishable, sometimes impalpable; the dentiform and some other imitative shapes are longitudinally streaked. Massive: composition impalpable; fracture uneven. Plates, and superficial coatings.

1. It is easily fusible before the blow-pipe, attended by intumescence, and it gives a globule of silver by a continuation of the heat. It is soluble in nitric acid.

2. *Analysis.*

	By Klaproth.	By Berzelius.
Silver	85·00	87·05
Sulphur	15·00	12·96

3. It has been found almost exclusively in veins, accompanied by a great variety of species, particularly by ores of silver, lead, and antimony; by Blende, several species of Pyrites, and by Calcareous Spar. Rarely, it is found with Native Gold. The rock adjoining the veins is often impregnated with it, and it is itself covered with Silver-black, which sometimes owes its formation to the decomposition of Vitreous Silver.

4. It occurs at Freiberg, Marienberg, Annaberg, Schneeberg and Johanngeorgenstadt in Saxony; in Bohemia, principally at Joachimsthal; at Schemnitz and Cremnitz in Hungary. Other localities are Siberia, Mexico and Peru.

5. It is a valuable ore for the extraction of silver.

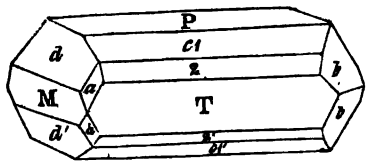
VIVIANITE. Prismatic Iron-Mica.

Primary form. Right oblique-angled prism. M on T = 125° 18′.

Vivianite.

Secondary form.

Fig. 467.



P on c1	-	125°	56′	PHILLIPS.	b	on b	-	148°	5′
P on d	-	135	35		c1	on a	-	140	35
T on c1	-	143	40		c1	on d	-	134	5
T on c2	-	165	25		c1	on b	-	125	40
T on b	-	125	25		c	on c1	-	108	30
M on c1	-	117	40		c1	on c2	-	157	45
M on d	-	150	30		d	on d	-	120	45

Cleavage, parallel with P highly perfect; traces in other directions. Fracture, not observable. Surface, P smooth; the rest of the faces streaked parallel to the edges of combination of P.

Lustre pearly, almost metallic on P. The rest of the faces possess vitreous lustre.

Color pale blackish-green ... indigo blue. It is green at right angles to the axis, but of a pure blue color parallel to it. The united effect of both, produces the common dirty indigo-blue color. Streak bluish white, very soon changing to indigo-blue. The powder produced by crushing the mineral in a dry state, is liver-brown. Transparent... translucent; least transparent in the direction of the axis.

Sectile. Thin laminæ are perfectly flexible.

Hardness = 1·5 ... 2·0, the lowest degrees upon P. Sp. gr. = 2·661, crystal from Cornwall.

Compound Varieties. Small reniform and globular shapes, and imbedded nodules; also superficial coatings of

dusty particles. Composition impalpable, earthy or easily reduced to powder.

1. When heated before the blow-pipe, it decrepitates, but if reduced to powder, melts into a dark brown or black scoria, which affects the magnetic needle. It is soluble in dilute sulphuric, and nitric acids. The friable varieties are found white in their original repositories, but like the white powder of the crystals, they soon assume a blue tinge, on being exposed to the air.

2. *Analysis.*

	By Vogel. fr. Bodenmais.	By Thomson. fr. N. Jersey.	By Stromeyer. fr. Cornwall.
Protoxide of iron	41·00	42·65	42·38
Phosphoric acid	26·40	24·00	28·69
Water	31·00	25·00	28·93

3. It is found attending Iron Pyrites in copper and tin veins, in narrow veins traversing greywacke with Native Gold, along with Magnetic Iron, and in trap rocks. The compound friable varieties are imbedded in clay, and in bog-iron ore.

4. It is found with Native Gold at Vöröspatak in Transylvania, at St. Agnes, Cornwall, and in Bodenmais, Bavaria. The earthy variety is found in Carinthia, Stiria, and Thuringia, in the Shetland Islands, and the Isle of Man.

It occurs in considerable abundance at Allentown, Monmouth county, (N. J.) and in its vicinity, imbedded in bog-iron ore, and associated with clays: in the former instance, it is crystallized in nodules, as well as massive; and in the latter, earthy. It is often found in this region filling up Belemnites and Gryphites, in the ferruginous sand formation.

Volkonskoite.

Massive; divisible into laminæ in one direction.

Color grass-green.

1. When thrown into water, it falls to fragments with a hissing noise.

2. It contains about 0·07 oxide of chrome.

3. It is found in the district of Okhousk, Perm in Russia, where it occurs in beds and veins.

Vulpinite. (See *Anhydrite.*)

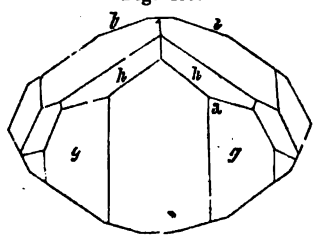
Wad. (See *Pyrolusite.*)

WAGNERITE. Hemi-prismatic Fluor-Haloide. PARTSCH.

Primary form. Oblique rhombic prism. M on M= 95° 25′. P on M=109° 20′.

Secondary form. The primary, having its lateral edges bevelled, the new planes upon the obtuse edges inclining under angles of 117° 32′, those upon the lateral edges under angles of 122° 25′. The bevelling faces on the obtuse edges are likewise truncated. The annexed figure repre-

Fig. 468.



sents the top of the crystal. *a* is not a right angle; *b*, *k*, and *g*, if enlarged, would produce parallel edges of combination.

Lustre vitreous. Color several shades of yellow, sometimes nearly orange-yellow, often inclining to grey. Streak white. Translucent.

Hardness=5·0 . . . 5·5. Sp. gr.=3·01 . . . 3·13.

1. Before the blow-pipe, it melts with difficulty into a dark greenish grey glass. It easily dissolves with borax and salt of phosphorus, into a transparent glass. Treated with warm sulphuric acid, it evolves fluoric acid in the state of powder.

2. *Analysis.*

By FUCHS.

Phosphoric acid	41·73
Magnesia	46·66
Fluoric acid	6·50
Oxide of iron	5·00
Oxide of manganese	0·50

3. It occurs in short and irregular veins of Quartz, in clay-slate, in the valley of Höllgraben, near Werfen in Salzburg.

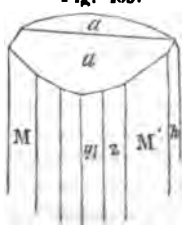
WATER. Pure Atmospheric-Water. MOHS. Amorphous. Transparent. Liquid. Sp. gr. = 1·0. Without odor or taste.

1. It consists of oxygen 88·94, and hydrogen 11·06; but contains various proportions of earthy substances, salts and acids, which considerably affect its taste, odor and specific gravity. If the temperature be below 32°, it assumes the condition of ice, snow or hail, or if sufficiently elevated, it is converted into vapor or steam. The crystals of ice or snow resemble the regular compositions of White Lead-Ore. The grains of hail are compound; those which fall during the changeable season of spring have the form of spheric sections, consisting of thin prisms, radiating from the centre, which prisms are columnar particles of composition, and commonly opake. The hail formed during heavy thunder storms, usually assumes the shape of irregular flattish globules; it is also compound, but often perfectly transparent, and including air bubbles.

2. Water in its ordinary state, or in the form of dew, mist, rain, snow, hail and ice, is spread over the entire surface of the globe.

WAVELLITE. Prismatic Wavelline-Spar. Primary form. Right rhombic prism. M on M = 122° 15′.

Secondary form. Fig. 469.



a on *a*	-	-	107°	26′	PHILLIPS.
a on *g*1	-	-	122	24	"
*g*1 on *g*2	-	-	174	45?	"
*g*1 on *h*	-	-	112	30?	"
*g*2 on *h*	-	-	112	25	"

Cleavage, parallel with M and the longer diagonal of the base, perfect. Implanted globules; composition columnar. Surface drusy.

Lustre of the faces of cleavage intermediate between pearly and vitreous. Color white, passing into several shades of green, blue, yellow, brown and black. Translucent.

Hardness=3·5...4·0. Sp. gr.=2·337, of the variety from Barnstaple.

1. Before the blowpipe it loses its lustre and transparency, but does not melt. With boracic acid and iron wire, it yields a globule of phosphuret of iron.

2. *Analysis.*

	By Berzelius.	By Fuchs.	By Steinmann. var. Kakoxene.
Alumina	35·35	37·20	10·01
Phosphoric acid	33·40	35·12	17·86
Fluoric acid	2·06	0·00	0·00
Lime	0·50	0·00	0·15
Ox. of iron and mang.	0·00	0·00	Peroxide of iron 36·82
Silica	0·00	0 00	8·90
Water	28·00	28·00	With fluoric acid 25 95

3. It occurs at Barnstaple in Devonshire, in small veins in clay slate; at St. Austle in Cornwall, in veins traversing granite, accompanied by Fluor, Tin-Ore, Yellow Copper Pyrites, &c.; in the Shiant isles in Scotland; at Zbirow near Beraun in Bohemia, in a kind of sandstone or grit; at Amberg in the Upper Palatinate, with Limonite; and in handsome bluish green varieties near Cork in Ireland, and in Brazil. The variety called *Kakoxene*, of an ochre-yellow color from Bohemia, has, according to Breithaupt, a sp. gr. = 3·38, or rather less. It appears, however, to belong to Wavellite, though a large intermixture of decomposed Limonite, or Iron-Ochre, tends to disguise its properties.

WEBSTERITE.

Reniform, massive: composition impalpable. Surface dull. Fracture fine grained and earthy. Friable.

Color white. Streak white, a little glimmering. It soils. Opake.

Sp. gr.=1·669.

1. It is fusible with difficulty. It is readily soluble in the acids. It imbibes water, but does not in consequence, fall to pieces.

2. *Analysis.*

	By Stromeyer.		By Dumas.
	fr. Halle.	fr. Newhaven.	fr. Auteuil.
Alumina	30·262	29·868	30·0
Sulphuric acid	23·365	23·270	23·0
Water	46·327	46·762	47·0

3. It is found at Halle in Prussia, in beds of plastic clay, and also filling up fissures in chalk, and in small globular masses, at Newhaven in Sussex, and at Auteuil near Paris.

Weissite.

Primary form. Oblique rhombic prism.

Lustre pearly. Color ash-grey. Translucent.

Hardness, scratches glass.

1. *Analysis.*

By Wachmeister.

Silica	53·69
Alumina	21·70
Magnesia	8·99
Protoxide of iron	1·42
Protoxide of manganese	0·63
Potash	4·10
Soda	0·68
Oxide of zinc	0·30
Water	3·20

2. It is found with a chloritic Talc in Erik-Matts, at Fahlun in Sweden.

Wernerite. (See *Scapolite.*)

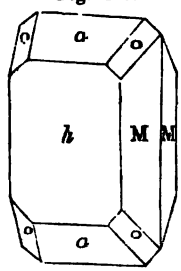
WHITE ANTIMONY. Prismatic Antimony-Baryte. Mohs.

Primary form. Right rhombic prism. M on M = 136° 58′.

White Antimony.

Secondary form.

Fig. 470.



h on *a* - - - - 144° 44′

Cleavage, parallel to M highly perfect, and easily obtained. Fracture not observable. Surface, M very even, though sometimes a little rough; *h* smooth and even; *a* and *o* curved.

Lustre adamantine, particularly upon the curved faces; upon *h*, often pearly lustre. Color white, prevalent; passing into peach-blossom-red and ash-grey. Streak white. Semi-transparent... translucent.

Sectile. Hardness=2·5...3·0. Sp. gr.=5·566, the simple crystals from Braunsdorf.

Compound Varieties. Crystals, compressed between *h* and *h*, are joined parallel to this face. If the individuals be very thin, the common varieties of this species are formed, which were formerly considered as simple forms, and the faces of composition as faces of cleavage. Massive: composition granular, lamellar, columnar; faces of composition of the granular individuals, in general, irregularly streaked.

1. It melts in the flame of the candle. Before the blow-pipe upon charcoal, it is entirely volatilized; and produces a white coating upon the

support. It is soluble in nitro-muriatic acid. It is frequently produced during chemical operations, and crystallized from sublimation.

2. It consists of

Antimony	84·32
Oxygen	15·68

3. It occurs in small quantities in veins, traversing primitive or greywacke rocks, associated with ores of lead and antimony, with Blende, Calcareous Spar and Quartz.

4. Beautiful varieties of aggregated tabular crystals are found at Przibram in Bohemia, and prisms of considerable thickness at Braünsdorf in Saxony. Other localitities are Malaczka in Hungary, Baden in Nassau, and Allemont in Dauphiny.

WHITE ARSENIC. Octahedral Arsenic-Acid. Mohs.

Primary form. Regular octahedron.

Reniform, botryoidal, stalactitic, thin crusts. Massive: pulverulent.

Color white, often inclining to yellow. Streak white. Lustre vitreous, inclining to adamantine. Translucent... opake.

Sp. gr.=3·698. Taste sweetish astringent.

1. If exposed to a high degree of temperature, it is entirely volatilized; upon ignited charcoal, it emits a strong garlick smell. Its white smoke condenses itself again upon cold bodies. It is soluble in water.

2. *Analysis.*

By Berzelius.

Arsenic	75·82
Oxygen	24·18

3. It is found in metalliferous veins, where it probably owes its existence to the decomposition of other minerals. It has been found at Andreasberg in the Hartz, at Joachimsthal in Bohemia, and at Bieber in the principality of Hanau, &c.

WHITE COPPERAS.

Crystals, having six lateral faces terminated by pyramids, with six truncated faces; the angle which two faces of the pyramid, form = 128° 8′, their inclination to the lateral faces =119°, and their angles with the truncature =151°.

Color white, with a pale tinge of violet.

Compound Varieties. Massive: granular.

1. It is wholly dissolved in cold water; but in hot, it deposits oxide of iron and silica.

2. *Analysis.*

		By Rose.
Silica	0·31	0·37
Sulphuric acid	43·55	43·55
Oxide of iron	24·11	25·21
Alumina	0·92	0·78
Lime	0·73	0·14
Magnesia	0·32	0·21
Water	30·10	29·98

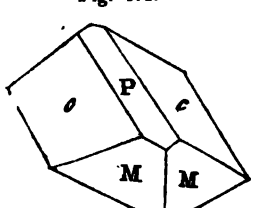
3. It is found in abundance in the province of Copiapo, a province in the north of Chili, near Bolivia; and is apparently derived from the decomposition of a bed of Iron and Copper Pyrites, mingled with Feldspar.

WHITE IRON-PYRITES. Prismatic Chlorone-Pyrites.

Primary form. Right rhombic prism. M on M = 106° 2′.

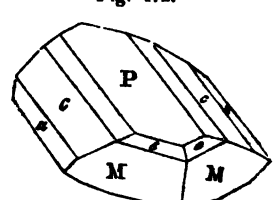
Secondary forms.

Fig. 471.



Warwick, (N. Y.)

Fig. 472.



Cornwall.

White Iron-Pyrites.

P on *c*	- - - -	160° 48′
P on *a*	- - - -	130 00
a on *c*	- - - -	141 30

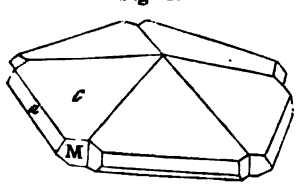
Cleavage, parallel with M rather perfect. Fracture uneven. Surface, *c* and *a* deeply streaked parallel to their edges of combination with P.

Lustre metallic. Color pale bronze-yellow, sometimes inclining to green or grey. Streak greyish-black, or brownish black.

Brittle. Hardness = 6·0 . . . 6·5. Sp. gr. = 4·678, crystals from Schemnitz; 4·847, crystals from Littmitz.

Compound Varieties. Twin-crystals: 1. Face of composition parallel, axis of revolution perpendicular to a face of M. This composition is generally repeated, as in the annexed figure, where a group of five individuals is formed,

Fig. 473.



having much the appearance of a five-sided pyramid with truncated apices, each of the five solid angles at the base presenting a re-entering angle. 2. Face of composition parallel, axis of revolution perpendicular to *a* and *c*. This composition takes place in varieties already compounded by the first law. They assume a grooved appearance. The re-entering angle formed by the faces P = 114° 19′. Globular, reniform, stalactitic and other imitative shapes: surface drusy; composition columnar, individuals straight,

and generally small, or even impalpable. There is sometimes a second curved lamellar or granular composition, the faces of composition being uneven or rough. Massive: composition as in the imitative shapes; fracture even, flat conchoidal, uneven. Pseudomorphoses in low, nearly regular, six-sided prisms. Cellular.

1. The present species has been subdivided into varieties depending upon the shape and composition of the crystals, and several accidental circumstances. The crystals of *Radiated Pyrites* are generally simple. *Spear Pyrites* is found only in compound crystals, consisting of two, three, or a greater number of individuals regularly grouped. *Cockscomb Pyrites* occurs both in simple and in compound crystals of a particular form, with indentations along their edges, and a color much inclining to green or grey.

2. Before the blow-pipe, it becomes red upon charcoal, the sulphur is driven off, and oxide of iron remains. Some of the varieties are particularly liable to decomposition.

3. *Analysis.*

By Berzelius.

Sulphur	53·35
Iron	45·07
Manganese	0·70

4. It abounds in beds of coal, and in the accompanying strata of clay. It also occurs in metalliferous veins, with ores of silver, lead and copper.

5. Radiated, hepatic, (pseudomorphoses, consisting of Iron Pyrites,) and cellular Pyrites, are found in several parts of Saxony; hepatic pyrites at Johanngeorgenstadt, radiated and spear Pyrites at Joachimsthal, Littmitz and Altsattel in Bohemia; the former also at Schemnitz in Hungary, and Almerode in Hessia; Cockscomb Pyrites in Derbyshire. Spear Pyrites and Radiated Pyrites, in beautiful stalactitic groups, abound in Cornwall.

Crystallized varieties of this species are only known from Warwick, (N.Y.) in the United States, where they occur in single crystals, imbedded, with Zircon, in granite. Massive, fibrous varieties, abound throughout the mica-slate formation of New England, in particular with Cummingtonite and Garnet, in Cummington, (Mass.) It is found at Lane's mine in Monroe, and in the Topaz and Fluor vein at Trumbull, (Conn.); in gneiss at East Haddam, and in numerous other places.

White Lead-Ore.

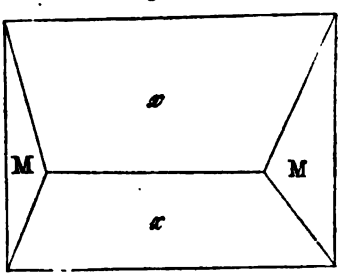
5. It is employed, like the Iron Pyrites, in the manufacture of sulphur, copperas and sulphuric acid.

WHITE LEAD-ORE. Di-prismatic Lead-Baryte. MOHS.

Primary form. Right rhombic prism. M on M=117°.

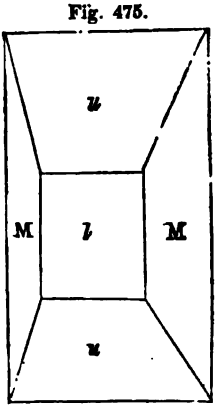
Secondary forms.

Fig. 474.



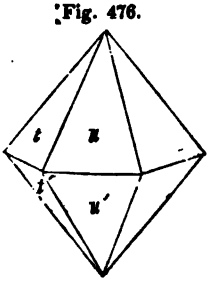
Nertschinsk, Siberia.

Fig. 475.



Johanngeorgenstadt.

Fig. 476.



White Lead-Ore.

Fig. 477.

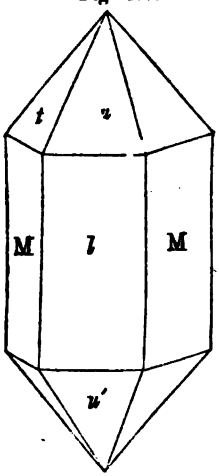


Fig. 478.

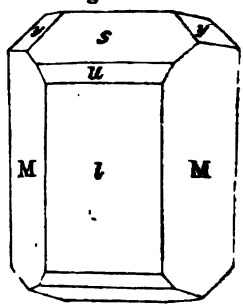


Fig. 479.

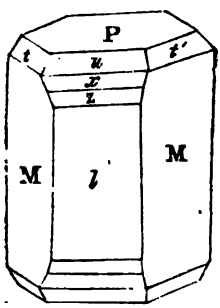


Fig. 480.

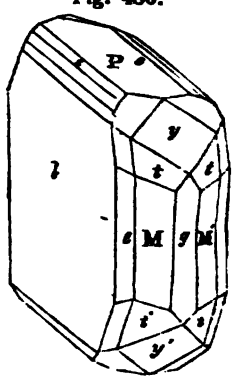


Fig. 474. Primary, having the acute angles deeply truncated. x on $x = 127° 20'$. (*octaèdre*. H.)—Fig. 475. Primary, having the acute angles replaced by single planes, and the acute lateral edges truncated. l on $u = 144° 44'$.

(H.) M on $l=121^\circ\ 28'$. (H.) (*quadrihexagonal.* H.)—Fig. 476. The same, with the addition of the replacement of the obtuse angles by two planes. t on $t'=107^\circ\ 6'$. (*dodécaèdre.* H.)—Fig. 477. A combination of fig. 475 and fig. 476. M on $t = 143^\circ\ 33'$. (H.) (*trihexaèdre.* H.)—Fig. 478. l on $s=109^\circ\ 29'$. (H.) (*sexduodécimal.* H.)—Fig. 479. P on $t=126^\circ\ 27'$. (H.) P on $u=125^\circ\ 16'$. (H.) P on $x=116^\circ\ 20'$. (H.) P on $z=109^\circ\ 29'$. (H.) (*octovigésimal.* H.)

Cleavage, parallel with M and h often perfect, generally interrupted by conchoidal fracture. Fracture conchoidal. Surface, M and h almost always much streaked vertically, and several of the pyramidal faces horizontally.

Lustre adamantine, passing into resinous. The former is often metallic if the colors be dark. Very thin crystals, and columnar compositions of them, often possess pearly lustre. Color white, prevalent, passing into yellowish grey, ash-grey, and smoke-grey, or even into greyish black. Sometimes, tinged green or blue by several of the salts of copper. Streak white. Transparent... translucent.

Rather brittle. Hardness = 3·0...3·5. Sp. gr. = 6·465, of a white translucent variety.

Compound Varieties. Twin-crystals; axis of revolution perpendicular, face of composition parallal to one of the faces of M. The composition is often repeated, not only in parallel laminæ, as in Arragonite, but likewise parallel to both the faces of M. The individuals are generally continued beyond the face of composition. Thus are formed the star-like crystals represented in the annexed

White Lead-Ore.

Fig. 481.

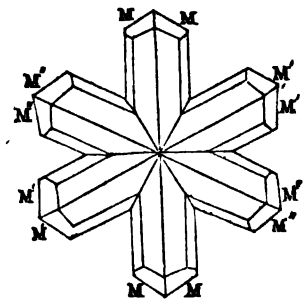


figure. Massive: compostion often granular, or even impalpable, and strongly connected, more rarely columnar. Faces of composition rough, or longitudinally or irregularly streaked.

1. Before the blow-pipe, it decrepitates, and changes its color into yellow and red; if properly managed, it yields a globule of metallic lead. Reduced to powder, and thrown upon ignited charcoal, it emits a phosphorescent light. It dissolves with effervescence in dilute nitric acid.

2. *Analysis.*

By KLAPROTH.

Oxide of lead - - - - - -	82·00
Carbonic acid - - - - - -	16·00
Water - - - - - - -	2·00

3. It occurs in veins and beds in various classes of rocks, accompanied chiefly by Galena and other salts of lead.

4. Fine crystallized varieties occur in the various mining districts of Saxony, Hartz, Bohemia, Carinthia and France. Splendid crystals are brought from the Daurian mountains in Siberia, on the frontiers of China. Very beautiful varieties are found at Wanlockhead and the Lead Hills in Scotland, in the mines of Cumberland and of Cornwall.

Very distinct and beautiful crystals were formerly obtained at the Perkiomen Lead mine near Philadelphia. It also exists in Missouri, at Valle's Diggings, Jefferson co.; and in small quantity at the Southampton lead mine, (Mass.)

WHITE VITRIOL. Prismatic Vitriol-Salt. MOHS.

In efflorescences and crusts. It crystallizes in right rhombic prisms. M on M = 90° 42′.

Lustre vitreous. Color white. Translucent.

Brittle. Hardness = 2·0 . . . 2·5. Sp. gr. = 2·036. Taste astringent, nauseous and metallic.

1. It is very easily soluble in water; before the blow-pipe it froths, and covers the charcoal with a white coating.

2. *Analysis.*

By KLAPROTH.

Oxide of zinc	27·5
Oxide of manganese	0·5
Sulphuric acid	20·0
Water	50·0

3. It arises from the decomposition of Blende, and is found in small quantity in the Rammelsberg near Goslar in the Hartz, at Schemnitz in Hungary, at Fahlun in Sweden, at Holywell in Flintshire.

WILLEMITE. Axotomous Zinc-Baryte.

Primary form. Rhomboid. P on P about, = 133°.

Secondary form. Six-sided prism terminated by the faces of the primary rhomboid.

Cleavage, indistinct, perpendicular to the axis of the rhomboid, or parallel with the base of the six-sided prism.

Lustre resinous. Color white, yellowish or red. Translucent or opake.

Hardness = 5·0 . . . 5·5. Sp. gr. = 4·0 . . . 4·1.

Compound Varieties. Reniform. Massive, impalpable. Color reddish brown.

1. It consists of a silicate of zinc with a very little oxide of iron.
2. It occurs with Calamine upon the Old mountain in Limburg.

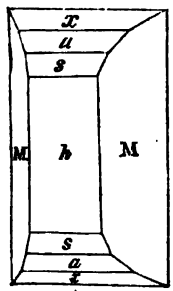
WITHAMITE. (See *Epidote.*)

WITHERITE. **Di-prismatic Hal-Baryte.**
Mohs.

Primary form. Right rhombic prism. M on M = 118° 30′.

Secondary form.

Fig. 482.



Anglesack.

M on M′	-	-	61°	30′	PHILLIPS.
h on *s*	-	-	145	30	"
h on *a*	-	-	126	16	"
h on *x*	-	-	110	30	"

Cleavage, parallel with M and *h* imperfect. Fracture uneven. Surface, M horizontally streaked.

Lustre vitreous, inclining to resinous. The latter more distinct in the fracture. Color white, generally yellowish, approaching to orange-yellow; sometimes passing into various shades of grey. Streak white. Semi-transparent... translucent.

Brittle. Hardness = 3·0 ... 3·5. Sp. gr. = 4·301, a white semi-transparent cleavable variety.

Compound Varieties. Twin-crystals: axis of revolution perpendicular, face of composition parallel to a face of M. The individuals continued beyond the face of com-

position. The composition repeated, so as to give rise to a six-sided prism, as in Arragonite. Globular, tuberose, reniform, botryoidal shapes: surface rough, uneven, and drusy; composition granular, often strongly coherent. Massive: composition either granular, or columnar; more frequently the latter.

1. Before the blow-pipe, it decrepitates slightly, and melts easily into a transparent bead, which loses its transparency on cooling. It is soluble with effervescence in dilute nitric acid.

2. *Analysis.*

By Bucholz.

Baryta	79·66
Carbonic acid	20·00
Water	0·33

3. It occurs in veins traversing limestone which rests upon red sandstone; it is also found in lead-veins traversing greywacke, and in irregular beds along with Ankerite in clay-slate.

4. It exists abundantly in the counties of Durham, Westmoreland, Lancaster, and Salop, (England) in veins; also near Neuberg in Stiria in irregular beds. It has been mentioned from Hungary, Salzburg, Siberia, Sicily, and other places.

5. It is a violent poison.

Wœrthite. (See *Kyanite.*)

Wolchouskoit.

Massive: composition impalpable. Fracture conchoidal. Color bluish green. Streak similar to color. Opake, adheres slightly to the tongue.

1. It consists of silica, alumina, oxide of chrome and water.
2. It is found in Siberia.

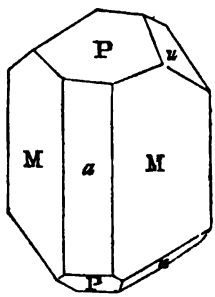
WOLFRAM. Prismatic Baryte-Ore.

Primary form. Oblique rhombic prism. M on M = 98° 12′.

Wolfram.

Secondary form.

Fig. 483.



Zinnwald.

P on *a*	- - -	116° 34′
u on *u* over P	- - -	98 12

Cleavage, parallel with *a* perfect. Fracture uneven. Surface, M and *a* streaked vertically. P sometimes curved.

Lustre metallic adamantine, or imperfectly metallic. Color dark greyish or brownish black. Streak dark reddish-brown. Opake.

Not very brittle. Hardness = 5·0 . . . 5·5. Sp. gr. = 7·155.

Compound Varieties. Twin-crystals: 1. Face of composition parallel, axis of revolution perpendicular to *a*. 2. Face of composition parallel, axis of revolution perpendicular to a face of *u*. There is often a curious composition in the exterior of crystals parallel to all their faces. Massive: composition irregularly lamellar, easily separated, faces of composition irregularly streaked; also columnar, the individuals being generally of a considerable size, straight

and divergent, and often rather strongly coherent. Pseudomorphoses in the shape of Tungsten.

1. When heated before the blow-pipe, it decrepitates, but may be melted in a sufficiently elevated temperature into a globule, having its surface covered with crystals possessing a metallic lustre. It dissolves readily in borax.

2. *Analysis.*

By Berzelius.

Tungstic acid	78·77
Protoxide of manganese	6·22
Protoxide of iron	18·32
Silica	1·25

3. It is frequently met with attending Tin-ore, in veins and beds. It also accompanies Galena in veins, traversing greywacke, and is found in beds and veins of Quartz, with Galena, Native Bismuth, Blende, &c.

4. It abounds in nearly all the tin-mines of Europe, and occurs in several places at Cornwall. It exists in greywacke in the principality of Anhalt; in the island of Rona one of the Hebrides, in graphic granite, and in Siberia with Beryl.

It is found in cleavable masses, columnar and nearly impalpable, and in large pseudomorphous crystals, at Lane's mine in Monroe, (Conn.) where it is associated with Tungsten, Tungstic-Ochre, Blende, Galena, Iron Pyrites, Native Bismuth, &c.; also in Trumbull, (Conn.) in the Topaz vein, but in smaller quantity.

Wollastonite. (See *Tabular-Spar.*)

Wolnin. (See *Heavy-Spar.*)

Wood-Copper. (See *Olivenite.*)

Wood-Opal. (See *Opal.*)

Wood Tin. (See *Tin-Ore.*)

Xanthite. (See *Idocrase.*)

XENOTIME. Prismatoidal Tungstic-Baryte.

Pimary form. Octahedron with a square base.

Xenotime.

Secondary form. The primary having the edges of the base deeply truncated.

Lustre resinous. Color yellowish brown.

Hardness = 4·5 . . . 5·5? Sp. gr. = 4·557.

1. Alone before the blow-pipe, it is infusible; but with soda, it affords a brisk effervescence and an infusible scoria.

2. *Analysis.*

By Berzelius.

Phosphoric acid with a little fluoric acid . .	33·49
Yttria	62.58
Sub-phosphate of iron	3·93

3. It has been found in small, imperfect crystals, near Lindenaes in Norway, in granite with Orthite.

Xylokryptite.

In delicate crystals.

Lustre vitreous. Color yellow.

1. It occurs in Lignite. Locality not mentioned.

Yellow Copperas.

In irregular six-sided tables, and in grains. Lustre pearly. Color yellow. Transparent.

1. *Analysis.*

By Rose.

Sulphuric acid	39·60
Oxide of iron	26·11
Alumina	1·95
Magnesia	2·64
Silica	1·37
Water	29·67

2. It is found investing white Copperas in the district of Copiapo, a province of Coquimbo.

Appendix to White Copperas.

1. *Fibrous Yellow Copperas.*

In fibrous concretions.

Lustre silky. Color yellowish green.

Yellow Copper Pyrites.

2. *Analysis.*

By Rose.

Sulphuric acid	31·73
Oxide of iron	28·11
Lime	0·91
Magnesia	0·59
Water	36·56
Silica	1·43

2. It is found with the above.

YELLOW COPPER PYRITES. Pyramidal Chlorone-Pyrites.

Primary form. Octahedron with a square base. P on P″ = 102° 55′.

Secondary forms.

Fig. 484.

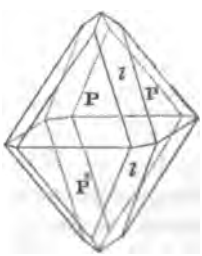
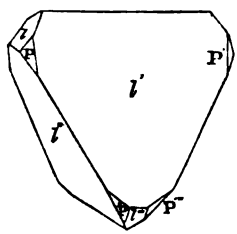


Fig. 485.



P on *l*	-	-	141°	15′	Phillips.
l on *l*	-	-	110	00	"
l′ on *l‴*	-	-	71	10	"
P on P″	-	-	125	30	"

Fracture conchoidal, more or less perfect. Surface, P streaked, parallel with the base; the alternating faces enlarged, faces of *l* are irregularly streaked. The remaining faces are almost all smooth, and often possess a high lustre.

Lustre metallic. Color brass-yellow. Streak greenish-black, a little shining.

Rather sectile. Hardness = 3·5 . . . 4·0. Sp. gr. = 4·169.

Compound Varieties. Twin-crystals: face of composition perpendicular to a face of P, similar to the common hemitrope in the regular octahedron. Globular, reniform, botryoidal, stalactitic, and other imitative shapes: surface generally rough, sometimes also smooth, composition impalpable, fracture flat conchoidal. Massive: composition granular, of various sizes of individuals, often impalpable, and strongly coherent, fracture uneven or flat conchoidal.

1. Upon charcoal, it becomes black before the blow-pipe, and red on cooling. It melts into a globule, which becomes magnetic if kept in the blast for some time. With borax, it yields a globule of copper. It is partly soluble in dilute nitric acid; the solution is green, and the undissolved part consists of sulphur.

2. *Analysis.*

By Rose.

Sulphur	35·37
Iron	29·82
Copper	34·81

3. It is found in veins and beds. In the latter, it is attended by various ores of iron and copper, by Galena, Blende, &c. In veins by a great variety of species among which several ores of silver frequently occur.

4. It occurs in numerous countries; but the finest crystals come from Freiberg and Cornwall. It occurs in the United States at several places; at the Southampton (Mass.) lead-mine with Galena and Blende, at Franconia, (N. H.) in gneiss, at Strafford and Schrewsbury, (Vt.) with Magnetic Iron Pyrites, &c.

5. It is a very valuable ore for the production of copper.

YELLOW LEAD-ORE. Pyramidal Lead-Baryte. Mohs.

Primary form. Octahedron with a square base. P on P″ = 130° 11′.

Yellow Lead-Ore.

Secondary forms.

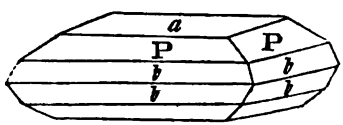
1.
Primary with the summits truncated.

2.
The same, with the edges of the base truncated.

3.
The same as 1. with the angles of the base truncated.

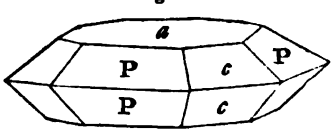
4.
Right square prism.

5. Fig. 486.



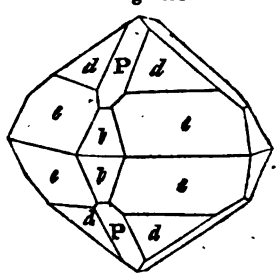
Annaberg, Austria.

6. Fig. 487.



Bleiberg, Carinthia.

7. Fig. 488.



Bleiberg, Carinthia.

1. (*basé.* H.)—2. (*sexoctonal.* H.)—3. (*epointé.* H.)—4. (*bisunitaire.* H.)—5. *b* on *b* = 99° 40′.—6. *c* on *c* = 128° 9′.—7. *d* on *d* = 118° 26′, *e* on *e* = 106° 44′.

Cleavage parallel to *b* very smooth, but often interrupted by conchoidal fracture: parallel to P and *a* less distinct, and not observable in every individual. Fracture conchoidal, generally imperfect. Surface *a* and particularly *b*, smooth; *a* sometimes striated parallel to the edges of

combination with *b*. *c* commonly, P often, and *e* always, rough.

Lustre resinous. Color generally wax-yellow; passing into siskin-green and olive-green, also into orange-yellow, yellowish-grey and greyish white. Streak white. Semi-transparent, translucent on the edges.

Brittle. Hardness = 3·0. Sp. gr. = 6·760, orange yellow, crystals from Annaberg in Austria.

Compound Varieties. Massive: composition granular, of various sizes of individuals and firmly coherent.

1. Before the blow-pipe, it decrepitates briskly, and assumes a darker color, which however, again disappears. Alone upon charcoal, it melts and is absorbed by it leaving behind some reduced globules of metallic lead. It is with difficulty soluble in acids.

2. *Analysis.*

	By Klaproth.	By Hatchett.
Oxide of lead	64·42	58·40
Molybdic acid	34·25	38·00
Oxide of iron	0·00	2·08
Silica	0·00	0·28

3. The present species is found in beds and veins in newer limestone, with ores of lead and zinc; more rarely also in veins with similar minerals in primitive rocks.

4. It occurs in many of the lead mines of Carinthia, as at Deutsch-Bleiberg and Windisch-Bleiberg, Windisch Kappel, &c. also at Annaberg in Austria. It is likewise found in limestone at Annaberg; and in the copper mines of Rezbanya in Upper Hungary. Other localities are Zimapan, Mexico and Moldawa, Bannat; at the latter place it is found in crystals of a hyacinth-red color. In the United States it occurs at the Perkiomen lead-mines, near Philadelphia, and in the lead-mine of Southampton, (Mass.); but at both of these places in limited quantities.

Yellow Tellurium. (See *Mullerite*.)

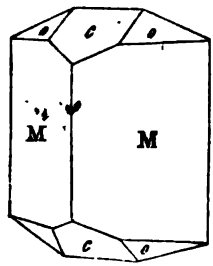
YENITE. Di-prismatic Iron-Ore. Mohs.

Primary form. Right rhombic prism. M on M = 112° 37′.

Yenite.

Secondary form.

1. Fig. 489.



Elba.

o on *o* - - - -	139° 37′
o on *o* over M - - -	77 16

2. The same with edges bevelled, together with planes between the bevelling planes and the summits.

Cleavage, parallel with the longer diagonal of the prism distinct; less so, parallel with M. Fracture imperfectly conchoidal, uneven. Surface, lateral planes streaked vertically, *o* parallel to its edges of combination between M and *a*.

Lustre imperfectly metallic. Color intermediate between iron-black and dark greyish black, passing into greenish black. Streak black, sometimes inclining to green or brown. Opake.

Brittle. Hardness = 5·5 ... 6·0. Sp. gr. = 3·994, a crystalline variety from Elba.

Compound Varieties. Massive: composition columnar, thin and straight, sometimes granular, the individuals being scarcely distinguishable.

1. After having been exposed to heat, it acts on the magnetic needle. Before the blow-pipe, it melts easily and without effervescence

into an opake glass, which is likewise magnetic. Glass of borax is colored by it, yellowish green. It is soluble in muriatic acid.

2. *Analysis.*

By STROMEYER.

Silica	29·278
Protoxide of iron	52·542
Lime	13·777
Protoxide of manganese	1·587
Alumina	0·614
Water	1·268

3. It is found in beds in primitive rocks, with Pyroxene, Hornblende, Garnet, Quartz and Magnetic Iron.

4. Its principal locality is the island of Elba, where it is found in crystals of considerable size. Other places where it is found, are Kapferberg in Silesia, Norway, and Siberia. But a single locality is known in the United States, which is at Cumberland, (R. I.) where it exists in long slender crystals traversing Quartz in seams and associated with Magnetic Iron and Hornblende.

YTTRO-CERITE. Prismatic Fluor-Haloide.

Primary form. Oblique rhombic prism?

Massive: composition granular. Cleavage parallel with the sides of an obliquè rhombic prism, whose lateral planes incline under angles of about 108° 30′. Fracture uneven. Lustre vitreous to pearly.

Color vitriol-blue, inclining to grèy and white; sometimes white on the surface. Opake.

Hardness = 4·5. Sp. gr. = 3·447.

1. Before the blow-pipe, it loses its color and becomes white before it glows, but is infusible by itself. With sulphate of lime, it melts into a globule, which becomes white on cooling.

2. *Analysis.*

By BERZELIUS.

Lime	47·63
Fluoric acid	25·05
Yttria	9·11
Oxide of cerium	18.22

3. It occurs at Finbo and Broddbo, near Fahlun in Sweden with Albite and Beryl, and is imbedded in Quartz.

YTTRO-TANTALITE. Monotomous Eruthrone-Ore.

Primary form. Octahedron with a square base? P on P over the base = 129° 32′.

In grains.

Cleavage in one direction pretty distinct. Fracture conchoidal, uneven, granular.

Lustre, iron-black, brownish black, yellowish brown. Streak grey, or greyish white. Translucent to opake.

Brittle. Hardness, scratches glass. Sp. gr. = 5·39 . . . 5·88.

1. It is infusible before the blow-pipe. In a powerful heat it assumes a yellowish or white color. It fuses with borax into a glass colored by iron. It is not attacked by acids.

2. *Analysis.*

By Berzelius.

	black variey.	yellow variety.	brown variety.
Columbic acid	57·00	60 124	51·815
Yttria	20·25	29·780	38·515
Lime	6 25	0·500	3·260
Oxide of iron	3·50	1·155	0·555
Oxide of uranium	0·50	6·622	1·111
Tungstic acid	8·25	1·024	with tin 2·592

3. It occurs at Ytterby, and near Fahlun in Sweden.

Zeagonite. (See *Gismondin.*)

Zeolite. (See *Mesotype.*)

ZINKENITE. Peritomous Antimony-Glance. Partsch.

Primary form. Right rhombic prism. M on M = 120° 39′.

In twin-crystals, and massive. The twin-crystals are six-sided prisms surmounted by six-sided pyramids whose faces correspond to the edges of the prism. The faces of the pyramid incline to one another under angles of 165° 30′, and to the lateral faces under 103°. The composition takes place like that of Witherite. Surface, the prismatic faces striated lengthwise.

Cleavage not observable. Fracture uneven. Lustre metallic. Color steel-grey.

Hardness=3·5. Sp. gr.=5·30 . . . 5·35.

1. Heated before the blow-pipe on charcoal, it decrepitates and melts very easily into small metallic globules, which are volatilized; during which, the charcoal is covered with a yellowish white crust.

2. *Analysis.*

By Rose.

Sulphur	21·68	22·58
Antimony	43·45	44·39
Lead	34.87	31·84
Copper	0.00	0·42

3. It is found at Wolfsberg in the Hartz, where it occurs imbedded in Quartz.

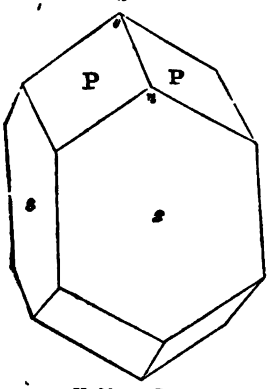
ZIRCON. Pyramidal Zircon. Mohs.

Primary form. Octahedron with a square base. P on P over the base =84° 20′, over a pyramidal edge =123° 19′.

Zircon.

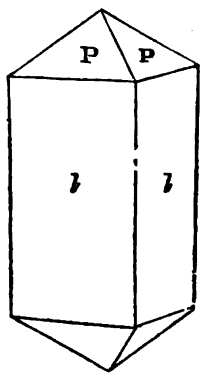
Secondary forms.

Fig. 490.



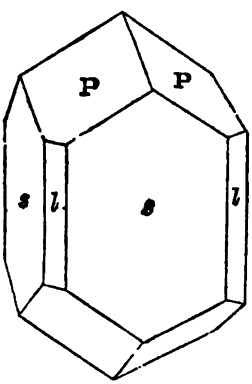
Haddam, (Conn.)

Fig. 491.



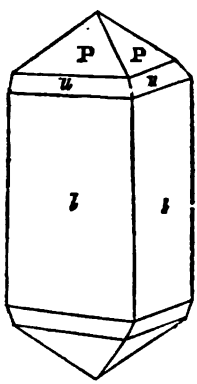
Buncombe co. (N. C.)

Fig. 492.



Warwick, (N. Y.)

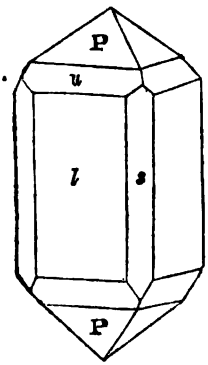
Fig. 493.



Edenville, (N. Y.)

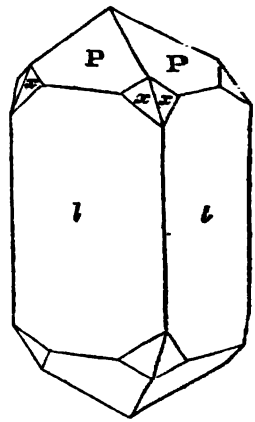
Zircon.

Fig. 494.



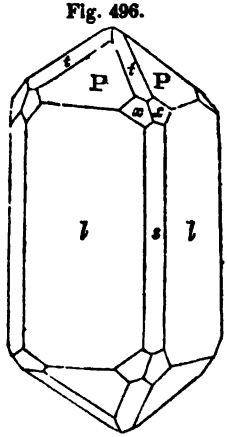
Buncombe co. (N. C.)

Fig. 495.



Middlebury, (Vt.)

Fig. 496.



Middlebury, (Vt.)—
Munroe, (N. Y.)

Fig. 490. The primary, having the angles of the base truncated. P on $s = 117° 48'$. (*dodécaèdre.* H.)—Fig. 491. The primary having the edges of the base truncated.

Zircon.

P on $l = 131° 49'$. (*prismé.* H.)—Fig. 492. The primary having both the edges and angles of the base truncated. (*dioctaèdre.* H.)—Fig. 493. P on $u = 152° 8'$. u on $l = 159° 17'$. (*quadrisexdécimal.* H.)—Fig. 494. P on $x = 150° 5'$. l on $x = 142° 55'$. x on $x = 147° 12'$. (*plagièdre.* H.)—Fig. 495. (*binotriunitaire.* H.)

Irregular forms and grains.

Cleavage, parallel with P and l, the latter more distinct; but rather perfect. Surface, t and s rough. The other faces are mostly smooth and shining.

Lustre, more or less perfectly adamantine. Color red, brown, yellow, grey, green, white; excepting some red tints, none of them bright. Streak white. Transparent to translucent.

Hardness = 7·5. Sp. gr. = 4·505.

1. Before the blow-pipe, it loses its color but does not melt.

2. *Analysis.*

By Berzelius.

Silica	33·62	33 30
Zirconia	66.38	66·70

3. Zircon is found in imbedded crystals in mountain masses, or in beds included in them, from whence it is washed into the sand of rivers.

4. It occurs with Epidote in the Saualpe in Carinthia, in sienite at Frederiksvärn in Norway. In Ceylon, in France, at Bilin in Bohemia, at Ohlapian in Transylvania, it occurs in the sand of rivers.

The largest and most perfect crystals afforded by the United States, have been found loose in the soil in Buncombe co. (N. C.) Handsome crystals are found in gneiss at Warwick, and in Magnetic Iron, at Munroe, and in Scapolite at Edenville, (N. Y.) Crystals closely resembling the variety from Norway, were found in loose masses of sienite at Middlebury, (Vt.) Large and handsome brown crystals occur in talcose slate at Easton, (Penn.) Small but very perfect forms are met with at Haddam, (Conn.) with Chrysoberyl, Garnet, &c.

5. Zircon is sometimes used as a gem, but it is not much esteemed.

ZOISITE. (See *Epidote.*)

ZURLITE.

Form, rectangular four-sided prisms, lengthened in the direction of the axis, and having sometimes their lateral edges replaced.

Cleavage indistinct. Fracture conchoidal. Surface rough, generally covered with a white coating, sometimes convex.

Lustre resinous. Color asparagus-green. Streak pearl-grey. Hardness about 6·0. Sp. gr. $=3·274$.

1. It is infusible before the blow-pipe, but yields with borax, a bluish glass. Nitric acid dissolves it, partly, with effervescence and assumes a yellow color.

It is found at Somma, with Dolomite.

CHEMICAL ARRANGEMENT

OF THE

SPECIES.

PRELIMINARY OBSERVATIONS.

THE nomenclature adopted in the present Tabular view of the chemical relations of the species, has been taken from an unpublished manuscript, by Mr. J. D. DANA. It resembles in several points that by BERZELIUS. Its peculiarities, however, are numerous, and hence a brief outline of its rules becomes necessary.

The elements are divided into two classes,—into *Amphigen* and *Oudegen Elements;* the former containing those which are electro-negative in acid and basic compounds, the second those whose mutual combinations produce neither acids nor bases.*

The binary compounds are named as follows: the adjective part of the name is derived from the name of the most electro-positive element, if the two elements of the compound are of the same class: but from the oudegen ele-

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* This distinction is natural; each element which is electro-negative in a class of acids being also electro-negative in a class of bases, with which the acids may unite and form salts. On the contrary, those elements which do not give rise to acids, do not give rise to bases.

ment, if one is from each of the classes. It is formed by the termination *ic* or *ous*. The substantive part of the name is formed by affixing to the other element the termination *acid*, if the compound will unite with bases and form salts, otherwise the syllable *ide*. Thus we have *mercuric chloracid*, (Horn Quicksilver,) and *zincic sulphide*, (Blende.) The different proportions in which any two elements combine, are expressed by the prefixes, *hypo*, *hyper* and *per* in the usual manner. The particle *sur* is prefixed to the substantive in the non-acid compounds of the Amphigen elements, when the electro-negative element exists in too large a proportion to enable them to act the part of bases; and the particle *sub*, when it is in too small a proportion.

Numerals are seldom used, except in the salts. They are prefixed to the substantive part of the name, unless they refer to the whole compound expressed by both adjective and substantive, in which case they are affixed to the adjective. The number of atoms of the substantive element are expressed by the Latin numerals, *bis*, *ter*, *quater*, &c.; that of the adjective element, by the Greek numerals, *dis*, *tris*, &c. Several atoms of both base and acid are expressed by a prefix, formed by combining the Latin and Greek numerals.

The names of the salts are formed as follows: The adjective of the name of the salt is derived from the adjective of the name of the base, and the substantive from the name of the acid, by changing the termination acid into *ate* if the adjective ends in *ic*, but into *ite* if it ends in *ous*, and prefixing to these terminations the initial syllable or syllables of the acidified substance.

For the sake of brevity, the distinguishing prefix *ox* in the oxacids is dropped; consequently the name for Coppe-

ras is the *ferrous sulphate*,—sulphate being a contraction for sulpho-oxate.

The compound salts are named by combining the names of the simple salts.

Whenever a star is prefixed to the chemical name of a species, or of a group of species in the following table, notice is given that the expression is not intended to convey an idea of the atomic constitution of the species or group. In such cases, the ingredients only are indicated.

TABULAR VIEW.

The mineralogical species constitute five Classes; which are variously subdivided into families, orders and genera.

CLASS I.

consists of Elements, and embraces two families, the Amphigen family, and the Oudegen family.*

Amphigen Family.	Oudegen Family.
Oxygen.	Nitrogen.
Sulphur.	Arsenic.
	Carbon, &c.

CLASS II.

embraces Acid compounds of the Amphigen elements, and includes three genera, which are named from the

* The order of succession in the families, orders, genera and species, is the electro-negative, according to the table of Berzelius, the most electro-negative being placed first.

electro-negative element in the compounds. The species derive their names from the electro-positive element of the combination.

GENUS I.	GENUS II.	GENUS III.
OXACID.	CHLORACID.	SULPHACID.
Sp. Sulphurous.	*Sp.* Hydric.	*Sp.* Selenous.
Arsenic,		Hypo-arsenous,
&c.		&c.

CLASS III.

consists of non-acid compounds of Amphigen elements, and contains seven genera, which, together with the species, are named as in Class II.

GENUS I.	GENUS II.	GENUS III.
OXIDE.	FLUORIDE.	CHLORIDE.
Sp. Chromic.	*Sp.* Ceric.	*Sp.* Mercuric.
Antimonic, &c.	Aluminic, &c.	Argentic, &c.

CLASS IV.

contains salts, or those compounds resulting from the union of acids and bases. It consists of two orders, Oxisalt and Sulphisalt. The genera and species are named as in the foregoing classes.

ORDER I. OXISALT.

GEN. I. Sulphate.	GEN. II. Nitrate.
Sp. Cupric.	*Sp.* Magnesic.
Plumbic, &c.	Calcic, &c.

ORDER II. SULPHISALT.

GEN. I. ARSENO-SULPHITE.	GEN. II. ANTIMONO-HYPO-SULPHITE.
Sp. Argentic tris-	*Sp.* Argentic,
	Argentic tris-

CLASS V.

consists of compounds of the Oudegen elements, and forms five genera, which derive their names from the most electro-negative element in the compound.

GEN. I. ARSENIDE.	GEN. II. CARBONIDE.
Sp. Cobaltic.	*Sp.* Hydrous.
Nickelic.	

CLASS I.

AMPHIGEN FAMILY.

Oxygen	*Oxygen.*
Sulphur*	*Native Sulphur.*

OUDEGEN FAMILY.

Nitrogen	*Nitrogen.*
Arsenic	*Native Arsenic.*
Carbon	*Diamond.*
	Anthracite.
	Plumbago.
Antimony	*Native Antimony.*
Hydrogen	*Hydrogen.*
Gold	*Native Gold.*
Platina	*Native Platina.*
Palladium	*Native Palladium.*
Mercury	*Native Mercury.*
Silver	*Native Silver.*
Copper	*Native Copper.*

* The remaining Amphigen Elements in Chemistry are, Fluorine, Chlorine, Bromine, Iodine, Selenium and Tellurium.

Bismuth	*Native Bismuth.*
Lead	*Native Lead.*
Iron	*Native Iron.*

CLASS II.

Genus I. Oxacid.

Sulphurous	*Sulphurous Acid.*
Sulphuric	*Sulphuric Acid.*
Arsenic	*White Arsenic.*
Molybdic	*Molybic-Ochre.*
Tungstic	*Tungstic-Ochre.*
Boric	*Sassolin.*
Carbonic	*Carbonic Acid.*
Antimonic	*White Antimony.*
Titanic	*Rutile.*
	Anatase?
Silicic	*Quartz.*
Hydrated	*Opal.*

Genus II. Chloracid.

Hydric	*Muriatic Acid.*

Genus III. Sulphacid.

Selenous	*Sulphoselenite.*
Hydric	*Sulphuretted Hydrogen.*
Hypo-arsenous	*Realgar.*
Arsenous	*Orpiment.*
Hypo-antimonous	*Grey Antimony.*

CLASS III.

Genus I. Oxide.

Section A. Simple.

Nitric sub-	*Atmospheric Air.*
Chromic	*Chrome-Ochre.*
Antimonic	*Antimony-Ochre.*
Hydric	*Water.*
Cuprous	*Red Copper-Ore.*
Cupric	*Melaconite.*
Uranous	*Pitchblende.*
Bismuthic	*Bismuth-Ochre.*
Stannic	*Tin-Ore.*
Plumbous sur-	*Minium.*
Cobaltic sur-	*Cobalt-Ochre.*
Ferric	*Specular Iron.*
Hydrated	*Limonite.*
Manganous	*Pyrolusite.*
Manganic	*Braunite.*
Hydrated	*Manganite.*
Aluminic	*Corundum.*
Hydrated	*Gibbsite.*
	Diaspore.
Magnesic	
Hydrated	*Native Magnesia.*

Section B. Mixed.

Ferrous & bi-ferric	*Magnetic Iron.*

Manganous & bi-manganic	*Black Manganese.*
*Ferric, ferrous, manganous, bi-manganic & zincic	*Franklinite.*

Genus II. Fluoride.

Section A. Simple.

Ceric	*Fluocerite.*
Aluminic	*Fluellite?*
Calcic	*Fluor.*

Section B. Mixed.

Aluminic & sodic	*Cryolite.*
*Ceric, yttric & calcic	*Yttrocerite.*

Genus III. Chloride.

Mercuric	*Horn Quicksilver.*
Argentic	*Horn Silver.*
Plumbic	*Kerasite.*
Sodic	*Common Salt.*
Ammonic	*Sal-Ammoniac.*

Appendix to Genus III.

(Combination of a chloride with an oxide.)

*Cupric ox. & chloride Hydrated	*Atacamite.*

Genus IV. Iodide.

Argentic	*Iodic Silver.*

Genus V. Sulphide.

Section A. Simple.

Molybdic	*Molybdenite.*
Mercuric	*Cinnabar.*
Argentic	*Vitreous Silver.*
Bismuthic	*Bismuthine.*
Cuprous	*Vitreous Copper.*
Plumbic	*Galena.*
Cobaltic	*Cobalt Pyrites.*
Nickelic	*Capillary Pyrites.*
Per-ferric	*Iron Pyrites.*
	White Iron Pyrites.
Zincic	*Blende.*
Manganic	*Mangan-Blende.*

Section B. Mixed.

Per-ferric & quinqui-ferrous	*Magnetic Iron Pyrites.*
Argentic & cuprous	*Stromeyerite.*
Argentic & ferrous	*Sternbergite.*
Ferrous & bi-cuprous	*Variegated Copper.*
*Copper, tin & iron	*Tin Pyrites.*
* Copper, bismuth & lead	*Cupreous Bismuth.*

Appendix to Genus V.

(Combination of a sulphide with an oxide.)

*Antimonic oxide & sulphide	*Red Antimony.*

Genus VI. Selenide.

Section A. Simple.

Cupric	*Selencuprite.*
Plumbic	*Clausthalite.*

SECTION B. MIXED.

Cuprous & argentic	*Eukairite.*

Genus VII. TELLURIDE.

SECTION A. SIMPLE.

Argentic	*Telluric Silver.*
Bismuthic	*Bornite.*
Plumbic	*Black Tellurium.*

SECTION B. MIXED.

Auric & argentic	*Graphic Gold.*
Mercuric & zincic	*Rionite.*
Bi-auric, argentic & plumbic	*Mullerite.*

CLASS IV. SALTS.

ORDER I. OXISALT.

Genus I. SULPHATE.

SECTION A. SIMPLE.

Cupric	*Brochantite.*
Hydrated	*Blue Vitriol.*
Plumbic	*Anglesite.*
Cobaltic	
Hydrated	*Cobalt Vitriol.*
Ferrous	
Hydrated	*Copperas.*
Ferric	
Hydrated	*White Copperas.*
Zincic	*White Vitriol.*

Aluminic	
Hydrated	*Solfatarite.*
Aluminic tri-	
Hydrated	*Websterite.*
Magnesic	
Hydrated	*Epsom Salt.*
Calcic	*Anhydrite.*
Hydrated	*Gypsum.*
Strontic	*Celestine.*
Baric	*Heavy Spar.*
Sodic	*Thénardite.*
Hydrated	*Glauberite.*
Potassic	*Aphthitalite.*

SECTION B. MIXED.

Cupric & uranic	
Hydrated	*Johannite.*
*Ferric & magnesic	
Hydrated	*Botryogene.*
Ter-aluminic & potassic	
Hydrated	*Alum.*
Calcic & sodic	*Glauberite.*
*Calcic, potassic & magnesic	
Hydrated	*Polyhalite.*

APPENDIX TO GENUS I.

(Combination of a sulphate and an oxide.)

*Plumbic sulphate & cupric oxide	*Cupreous Anglesite.*

Genus II. Nitrate.

Magnesic Hydrated	*Nitro-Magnesite.*
Calcic	*Nitrocalcite.*
Sodic	*Soda Nitre.*
Potassic	*Nitre.*

Genus III. Phosphate.

Section A. Simple.

Cupric Hydrated	*Pseudo-Malachite.*
Ferrous Hydrated	*Vivianite.*
Aluminic Hydrated	*Wavellite.*
Yttric	*Xenotime.*
Calcic	*Apatite.*

Section B. Mixed.

*Uranic & cupric, (or calcic) Hydrated	*Uranite.*
Ferrous & manganous	*Triplite.*
*Aluminic & magnesic	*Blue Spar.*
	Lazulite.
Aluminic ter- & lithic	*Amblygonite.*

Appendix to Genus III.

(Combination of a phosphate and a chloride.)

*Magnesic phosphate & chloride	*Wagnerite.*
Ter-plumbic phosphate & plumbic chloride	*Pyromorphite.*

Genus IV. Arsenate.

Cupric	*Olivenite.*
*Hydrated	*Erinite.*
	Copper Mica.
	Aphanesite.
	Euchroite.
Cobaltic	
Hydrated	*Cobalt Bloom.*
Nickelic	
Hydrated	*Nickel Green.*
Ferric	
Hydrated	*Cube Ore.*
	Skorodite.
Calcic	
Hydrated	*Pharmacolite.*
	Haidingerite.

Appendix to Genus IV.

(Combination of a phosphate with an arsenate.)

*Calcic phosphate & plumbic arsenate	*Hedyphane.*

Genus V. Chromate.

Section A. Simple.

Plumbic	*Red Lead Ore.*

Section B. Mixed.

*Cupric & plumbic	*Vauquelinite.*

Genus VI. Molybdate.

Plumbic	*Yellow Lead Ore.*

Genus VII. Tungstate.

Section A. Simple.

Plumbic	*Scheeletine.*
Calcic	*Tungsten.*

Section B. Mixed.

*Ferrous & manganous	*Wolfram.*

Genus VIII. Borate.

Magnesic	*Boracite.*
Sodic	
Hydrated	*Borax.*

Genus IX. Carbonate.

Section A. Simple.

Cupric di-	
Hydrated	*Green Malachite.*
Cupric tri-bi-	
Hydrated	*Blue Malachite.*
Uranic	*Uran-Bloom.*
Plumbic	*White Lead Ore.*
Ferrous	*Spathic Iron.*
Zincic	*Calamine.*
Manganic	*Diallogite.*
Calcic	*Calcareous Spar.*
	Arragonite.
Strontic	*Strontianite.*
Baric	*Witherite.*
Sodic	
Hydrated	*Natron.*
	Trona.

SECTION B. MIXED.

*Ferrous & magnesic	*Rhomb Spar.*
Magnesic & calcic	*Dolomite.*
	Ankerite.
Baric & calcic	*Baryto-Calcite.*
Calcic & sodic Hydrated	*Gay Lussite.*

APPENDIX TO GENUS IX.

(Combination of a carbonate and a chloride.)

Plumbic	*Corneous Lead.*

(Combination of a carbonate and a telluride.)

*Nickelic	*Herrerite.*

(Combination of a carbonate and a sulphate.)

Plumbic	*Lead Hillite.*
	Dyoxilite.
*Plumbic & cupric carbonate & cupric sulphate	*Caledonite.*

(Combination of a carbonate and an arsenate.)

*Cupric arsenate & calcic carbonate	*Kupaphrite.*

Genus X. COLUMBATE.

*Ferrous & manganous (sometimes stannic)	*Columbite.*
*Yttric & ceric	*Fergusonite.*
*Yttric & calcic (or uranic)	*Yttro-tantalite.*

Genus XI. TITANATE.

SECTION A. SIMPLE.

Calcic	*Pyrochlore.*

SECTION B. MIXED.

*Ferrous & ferric (also manganous)	*Crichtonite.*
Ceric & zirconic	*Aischynite.*
*Ferrous, zirconic & yttric	*Polymignite.*

Genus XII. SILICATE.

SECTION A. SIMPLE.

Cupric	
Hydrated	*Chrysocolla.*
	Dioptase.
Manganous	*Red Manganese.*
Ceric	
Hydrated	*Cerite.*
Zirconic	*Zircon.*
Aluminic-di	*Kyanite.*
*Hydrated	*Gmelinite.*
	Allophane.
Glucinic bi-	*Phenakite.*
*Magnesic	
Hydrated	*Pyrallolite.*
	Picrosmine.
	Picrolite.
	Talc.
	Serpentine.
	Kerolite.
Magnesic bi-	*Boltonite.*
Calcic	*Gismondin.*
Calcic bi-	*Tabular Spar.*

SECTION B. MIXED.

(Double.)

*Ferrous & manganous	*Troostite.*
*Ferric & aluminic	*Helvin.*
	Staurotide.
*Ferrous & magnesic	*Bronzite.*
	Peridot.
*Ferrous & calcic	*Yenite.*
*Ferric & sodic	*Achmite.*
*Aluminic & manganous	*Karpholite.*
*Aluminic & zirconic	*Bucholzite.*
*Aluminic & calcic	*Scapolite.*
*Hydrated	*Prehnite.*
	Mesotype.
	Brewsterite.
	Heulandite.
	Thomsonite.
	Edingtonite.
	Epistilbite.
	Stilbite.
	Laumonite.
	Levyne.
	Chabasie.
*Aluminic & glucinic	*Beryl.*
	Euclase.
*Aluminic & magnesic	*Nephrite.*
	Iolite.

*Aluminic & baric	
Hydrated	*Harmotome.*
*Aluminic & lithic	*Petalite.*
	Spodumene.
*Aluminic & sodic	*Albite.*
	Pitchstone.
Hydrated	*Analcime.*
*Aluminic & potassic	*Leucite.*
	Feldspar.
	Periklin.
	Andalusite.
	Nepheline.
	Figure-stone.
*Calcic & potassic	
Hydrated	*Apophyllite.*

(Ternary.)

*Ferrous, manganous & sodic	*Cummingtonite.*
*Thoric, ferrous & manganous	*Thorite.*
*Zirconic, calcic & sodic	*Eudyalite.*
*Yttric, cerous & ferrous	*Gadolinite.*
*Aluminic, ferrous & manganous	*Schiller Spar.*
*Aluminic, magnesic & ferrous	*Fahlunite.*
*Aluminic, calcic & ferrous	*Epidote.*
	Idocrase.
*Aluminic, calcic & sodic	*Labradorite.*
*Aluminic, calcic & potassic	*Pyroxene.*

(Quaternary.)

*Ferrous, aluminic, sodic & calcic	*Saussurite.*
*Aluminic, calcic, ferrous & ceric	*Allanite.*
*Aluminic, potassic, ferrous & lithic	*Mica.*
*Magnesic, calcic, aluminic & ferrous (or manganous)	*Hornblende.*
*Calcic, aluminic, ferrous & manganous	*Garnet.*
	Axinite.

APPENDIX TO GENUS XII.

(Combination of a silicate with a fluoride.)

*Aluminic silicate & fluoride	*Topaz.*
*Magnesic silicate & fluoride	*Brucite.*

(Combination of a silicate with a chloride.)

*Ferrous & manganous silicate & ferric chloride	*Pyrosmalite.*

(Combination of a silicate with a borate)

*Aluminic, ferrous (or manganous) & potassic (or sodic, lithic or magnesic)	*Tourmaline.*

(Combination of a silicate with a carbonate.)

*Bismuthic	*Bismuth Blende.*

(Combination of a silicate with a titanate.)

*Calcic	*Sphene.*

Genus XIII. Manganite.

Cupric	*Cupreous Manganese.*
*Zincic	*Red Zinc-Ore.*
Baric	*Psilomelane.*

Genus XIV. Alluminate.

Section A. Simple.

Plumbic	*Plumbo-Gummite.*

Section B. Mixed.

*Chromic & ferrous	*Chrome-Ore.*
*Zincic & magnesic	*Automalite.*
*Glucinic & ferrous	*Chrysoberyl.*

Genus XV. Mellate.

Aluminic	*Mellite.*

ORDER II. SULPHISALT.

Genus I. Arseno-Sulphite.

Section A. Simple.

Argentic tris-	*Proustite.*

Section B. Mixed.

*Cuprous & ferric	*Tennantite.*

Genus II. Antimono-Hypo-sulphite.

Section A. Simple.

Argentic	*Myargyrite.*

Argentic tris-	*Red Silver.*
Argentic hex-	*Black Silver.*
Plumbic bis-	*Zinkenite.*

SECTION B. MIXED.

*Cuprous & plumbic	*Bournonite.*
*Cuprous, zincic & ferrous	*Fahlerz.*

APPENDIX TO GENUS II.

(Combination of an antimono-hypo-sulphite with an arseno-sulphite.)

Cuprous arseno-sulphite & argentic antimono-hypo-sulphite	*Polybasite.*

Genus III. ANTIMONO-SULPHITE.

Plumbic di-ter-	*Jamesonite.*

CLASS V.

Genus I. ARSENIDE.

Cobaltic	*Cobaltine.*
Nickelic	*Copper Nickel.*
*Ferric	*Leucopyrite.*

APPENDIX TO GENUS I.

(Combination of an arsenide with a sulphide.)

Ferric	*Mispickel.*

Genus II. CARBONIDE.

*Hydrous	*Carburetted Hydrogen.*
	Bituminous Coal.
	Bitumen.

Genus III. Antimonide.

*Argentic	*Antimonial Silver.*

Appendix to Genus III.

(Combination of an antimonide with a sulphide.)

Nickelic	*Nickel Glance.*

Genus IV. Osmide.

Iridic	*Irid-osmium.*

Genus V. Mercuride.

Argentic	*Native Amalgam.*

APPENDIX.

ALBITE.

Very distinct crystals of this species are found at Williamstown, (Mass.,) where it is associated with Dolomite ?. Some of the crystals are three quarters of an inch in diameter, and highly transparent. They are pretty constantly twin-crystals, and very much modified. A similar variety is also found at Middletown, occupying druses in a coarse grained granite, consisting chiefly of Feldspar. The crystals at the last mentioned place are invariably compound.

ALLANITE. (See Vol. I. p. 6.)

The variety from Iglorsoit in Greenland, has a sp. gr. = 3·449. Before the blow-pipe, it swells up on first feeling the heat, but on continuing the heat, it melts into a black and very brittle vitreous pearl, which, while it is hot, exhibits a honey yellow color, and becomes greenish yellow when cold. The mineral gelatinizes in nitric, as well as in muriatic acid. According to STROMEYER, it contains

Silica	33·021
Alumina	15·226
Protoxide of cerium	21·600
Protoxide of iron	15·101
Protoxide of manganese	0·404
Lime	11·080
Water	3·000

ALUMOCALCITE.

Massive. Color milk-white, inclining to blue. Fracture conchoidal. Small fragments may be rubbed to pieces between the fingers. Sp. gr. = 2·174. Adheres strongly to the tongue.

It yields water in the glass tube, and becomes opake and grey colored when exposed to heat in the platina forceps. With borax, it forms a colorless glass. It is soluble in salt of phosphorus, with the exception of a silica-skeleton. In concentrated muriatic acid, it forms a transparent jelly. KERSTEN found it to consist of

Silica	86·60
Lime	6·25
Alumina	2·23
Water	4·00

It is found in the fissures of iron-stone veins at Eybenstock in the Erzgebirge. It was formerly confounded with Opal.

ANALCIME.

In large crystals in trap, at Keweena Point, Lake Superior.

Anthophyllite. (See Vol. I. p. 26.)

Its angles are precisely the same as those of Hornblende, with which species it is identical in other properties.

APATITE.

This species is found in crystals above an inch in length, and smaller, as well as massive, at Middletown, (Conn.), in granite. Its colors are bluish green, greyish and pinkish white. It is associated with Columbite, Uranite and Albite.

ARFWEDSONITE. (See Vol. I. p. 38.)

Analysis.

By Thomson.

Silica	50·50
Peroxide of iron	35·14
Deutoxide of manganese	8 92
Alumina	2·49
Lime	1·56
Water	0·96

ARRAGONITE.

Very beautiful massive varieties of this mineral, abound at Ball's Cave, Schoharie, (N.Y.) It forms stalactites and stalagmites of a snowy whiteness.

Arsenical Silver.

Mammillary, or consisting of very thin crystalline coats. Fracture uneven. Color resembling Native Silver, but tarnished externally. Lustre metallic, shining or glimmering. Sectile. Brittle. Streak shining.

Before the blow-pipe, it emits a strong arsenical odor, and a globule of pure silver remains, surrounded by a slag. It consists, according to KLAPROTH, of

Silver	12·75
Arsenic	35·00
Iron	44·25
Antimony	4·00

It occurs at Andreasberg in the Hartz, in Estremadura in Spain, and at Kongsberg in Norway.

ARSENIURET OF MANGANESE.

Botryoidal. Massive. Composition granular. Fracture uneven. Color greyish-white. Sp. gr. = 5·55.

1. In the air it becomes coated by a black powder. Before the blow-pipe, it burns with a blue flame, attended by a white smoke, and the odor of garlic. It is soluble in nitric acid.

2. *Analysis.*

By KANE.

Manganese	45·50
Arsenic	51·80
Oxide of iron	2·70

3. It is found in Saxony.

BERZELINE.

In extremely minute white crystals. Lustre vitreous. Feebly translucent. It is fusible with difficulty into a pale glass, and gelatinizes with heated acids. It appears to be anhydrous.

Its locality is Galloro, near La Ricia in the Roman states, where it is accompanied by black crystals of Garnet and pinchbeck Mica, in the drusy cavities of an augite-rock.

BIOTINE.

Fracture vitreous to conchoidal. Lustre brilliant. Color white or yellowish. Transparent. Presents double refraction. Hardness, scratches glass. Sp. gr. = 3·11.

It is not affected by the blow-pipe, and is only partly soluble in nitric acid.

It is found among the volcanic debris of Vesuvius.

BLACK TELLURIUM. (See Vol. I. p. 68.)

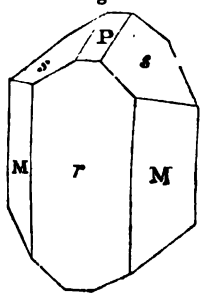
Analysis, by BERTHIER, of a variety from Nagyag. Sp. gr. = 6·84.

Gold	6·70
Tellurium	13 00
Lead	63·10
Antimony	4·50
Copper	1·00
Sulphur	11·70

BOTRYOGENE. (See Vol. I. p. 82.)

Secondary form.

Fig. 497.



M on M	119° 56′
s' on s	111 00

The above figure does not perfectly represent the crystals of Botryogene, inasmuch as face *r* does not exist, and the acute lateral edges are bevelled, the bevelling faces meeting under 81° 44′. The lateral planes striated vertically, and less perfectly formed, than the terminal planes.

BUCKLANDITE. Dystome Augite-Spar. HAIDINGER. (See Vol. I. p. 93.)

Sp. gr. = 3·945. ROSE; brilliant crystals in the lava of Lacher-See.

1. It is completely soluble in muriatic acid.

CARBONATE OF CERIUM.

In thin, four sided crystalline plates of a greyish-white color, and in coatings on Cerite. It does not change its appearance, though it loses

19 p. c. of its weight when exposed to a slight red heat. It occurs in very small quantity at Bastnaes in Sweden.

Carbonate of Lime and Soda.

Massive. Cleavage like Calcareous Spar. Transparent. Possesses double refraction. Before the blow-pipe it decrepitates a little, becomes brown, and is eventually reduced to lime. It is entirely soluble with effervescence in nitric acid. It contains

Carbonate of lime	70·00
Carbonate of soda	14·00
Water	9·7
Peroxide of iron	1·0

Its locality is not known.

CELESTINE.

Analysis.

By Daurier.

Sulphate of strontian	68·900
Sulphate of lime	0·105
Carbonate of lime	27·785
Oxide of iron	0·150
Oxide of manganese	0·050
Water	3·000

Chonikrite.

Massive: composition impalpable. Fracture uneven, and imperfectly conchoidal. Lustre glimmering, or dull. Color white, with shades of yellow and grey. Translucent, often only on the edges. Scratches Common Salt; is scratched by Fluor.

1. It melts before the blow-pipe easily, into a greyish glass. With borax, it slowly melts into a glass colored by iron. It is easily decomposed by concentrated muriatic acid.

2. *Analysis.*

By Kobell.

Silica	35·69
Alumina	17·12
Magnesia	22·50
Lime	12·00
Protoxide of iron	1·46
Water	9·00

3. It occurs in rounded masses at Elba.

CHROME ORE.

Analysis.

By Abich.

Alumina	11·85
Protoxide of chrome	60·04
Magnesia	7·45
Protoxide of iron	20·13

CHRYSOCOLLA.

It appears to be abundant at Keweena Point, Lake Superior, in connexion with the trap and sandstone formation.

Cobaltic Galena.

In minute moss-like groups of crystals, and massive. Cleavable. Lustre metallic. Color lead-grey, inclining to blue. Opake. Soils a little.

When heated before the blow-pipe, it splits into fragments, and communicates a smalt-blue color to borax.

Analysis.

By Du Menil.

Lead	62·89
Arsenic	22·47
Sulphur	0·47
Iron	2·11
Cobalt	0·94
Arsenical pyrites	1·44

It occurs in a vein of clay-slate, in one of the Clausthal mines in the Hartz.

COBALT PYRITES. Cobaltic Eruthleucone-Pyrites.

Primary form. Regular octahedron?

Massive; composition granular . . . impalpable. Individuals indistinctly cleavable. Fracture conchoidal, uneven.

Lustre metallic. Color pale steel-grey, rarely presenting a reddish tinge.

Hardness = 5·0 . . . 6·0.

1. Heated before the blow-pipe, it decrepitates briskly. Upon charcoal, it emits the odor of sulphurous acid, and melts into a magnetic globule, which is steel-grey on the surface, and bronze-yellow within.

2. *Analysis.*

	By WERNEKINCK.	By HISINGER.
Sulphur	42·25	38·50
Cobalt	53·85	43·20
Iron	2·30	3·53
Copper	0·97	14·40

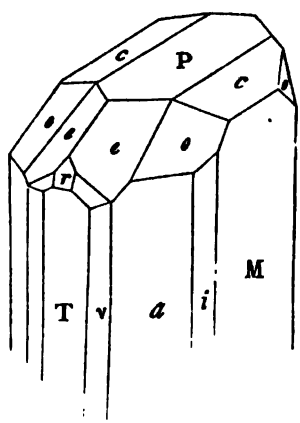
3. It is found in beds, at Riddarhyttan in Sweden, in gneiss.

COLUMBITE.

A very interesting deposit of this species has lately been discovered at Middletown, (Conn.) It exists in granite. The crystals are occasionally distinguished for their regularity and high degree of lustre, and are very generally of unusual dimensions for the species. One of these in the possession of Mr. F. MERRICK, the discoverer of the locality, weighs three or four ounces. Several of the angles of the annexed figure were obtained by means of the reflective goniometer.

Fig. 498.

T on *v*	-	-	157°	40′
T on *a*	-	-	129	30
T on *i*	-	-	112	10??
v on *a*	-	-	150	10
a on *i*	-	-	162	30?
M on *a*	-	-	140	40
M on *v*	-	-	107	45?
P on *c*	-	-	160	23
M on *e*	-	-	109	37
c on *o*	-	-	140	30
a on *o*	-	-	144	00
M on *o*	-	-	128	30
e on *e*	-	-	149	30
a on *e*	-	-	126	30
P on *e*	-	-	137	20?
P on *o*	-	-	127	00

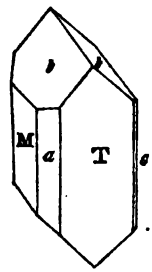


Associated with the crystals of Columbite are Apatite, Uranite and Albit .

COPPER PYRITES. (See *Yellow Copper Pyrites*, Vol. II. p. 283.)

CUPREOUS ANGLESITE. (See Vol. I. p. 159.)

Fig. 499.



M on T - - 95° 45′ | *b* on *b* - - 119°

Cleavage, very perfect parallel to M; less so parallel to *c*. Fig. 155 is probably a compound crystal.

CUPREOUS BISMUTH. (See Vol. I. p. 160.)

Analysis.

By H. FRICK.

Sulphur	16·61
Bismuth	36·45
Lead	36·05
Copper	10·59

EDINGTONITE. (See Vol. I. p. 178.)

Inclination of *a* on *a* over the summit = 129° 8′; of *b* to *b* = 92° 41′. It is referred by HAIDINGER to the genus Feldspar.

FLUOR.

It is very abundant on the banks of the Muscolonge lake, in the town of Alexandria, Jefferson co. (N.Y.) It occurs with Calcareous Spar in cavities in gneiss. It is limpid and colorless, or slightly tinged with green, and in cubical crystals of very great size, sometimes above a foot in diameter.

Forsterite. (See Vol. I. p. 214.)

Its cleavage, perpendicular to the axis, is very distinct. Hardness = about 7·0.

Fowlerite. (See *Manganese Spar.*)

Gansekothig-Erz.

Mammillary. Color yellow or pale green. Lustre resinous. Fracture conchoidal. Translucent. Shining, with a white streak. Hardness = 2·0 . . . 3·0.

Before the blow-pipe, it emits copious fumes of arsenic, and fuses into a blackish scoria; when the heat is continued on charcoal, the scoria melts, and yields a button of silver, but the slag contains metallic iron, which strongly affects the magnet. It is supposed to be an arseniate of silver and iron.

It occurs mostly in the mines of Clausthal in the Hartz, where it is of some importance as an ore of silver. It is likewise met with in Cornwall, and at Allemont in Dauphiny.

Gigantolite.

A mineral composed of alumina, lime and iron, found in the granitic rocks of Taméla in Finland.

Green Vitriol.

Massive, granular. Lustre dull. Color sometimes a fine green, more often of a greyish green.

1. It dissolves readily, and without alteration, in muriatic acid; slowly in ammonia, and rapidly in carbonate of ammonia.

2. *Analysis.*

By Berthier.

Deutoxide of copper - - - - -	66·20
Sulphuric acid - - - - -	16·60
Water - - - - -	17·40

3. It is found in Mexico.

Humboldtilite.

In right square prisms. Lustre vitreous. Semi-transparent. Fracture uneven. Color yellow, or yellowish grey. Hardness = 5·00. Sp. gr. = 3·104.

1. It fuses easily before the blow-pipe into a spongy, shining and transparent glass; with acids it forms a jelly.

2. *Analysis.*

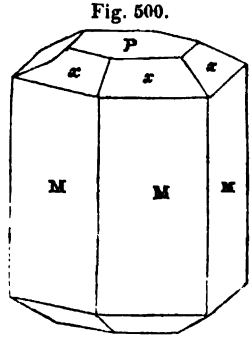
	By Monticelli & Covelli.	By Kobell.
Silica	54·16	43·96
Lime	31·67	31·96
Magnesia	8·83	6·10
Alumina	0·50	11·20
Oxide of iron	2·00	2·32
Soda	0·00	4·28
Potash	0·00	0·38

3. It occurs among the ejected minerals of Mount Vesuvius.

Hydroboracite. Hess. (See *Neues Jahrbuch für Min. Geog. Geol. u. Petre. von.* Leonhard u. Bronn, 1834. p. 353.)

IRIDOSMINE. (See Vol. I, p. 281.)

Fig. 500.



P on *z* - - - - - - 118°

Sp. gr. =19·38 . . . 19·47.

The crystals are shorter than in the annexed figure. Color tin white. Hardness =7·0. Undergoes no change before the blow-pipe, and emits no odor. They are found in the gold-sands of Newransk 95 wersts from Catharineburg, and in many other places in the Ural.

Crystals from Nischne Tagil have the same form, but a lead-grey color and a Sp. gr. =21·118. Before the blow-pipe their surface becomes dull, turns black and gives out the smell of osmium.

ISOPYRE. Isopyric Quartz. HAIDINGER. (See Vol. I, p. 287.)

It forms compact masses occasionally two inches in diameter in the granite of St. Just near Penzance, where it occurs associated with Tin Ore and Tourmaline. The *Tachylite* is found in basalt and wacke, at Säsebühl near Göttingen.

KUPAPHRITE. (See Vol. I, p. 295.)

It is found at the mines of Cohonas do Campo in Brazil, associated with Quartz and Magnetic Iron Pyrites.

LAUMONITE.

It is found in considerable quantity at Keweena Point, Lake Superior, in amygdaloid. Its color is reddish white, sometimes nearly brick-red, and its structure coarse granular. It is mingled with Calcareous Spar, and appears to be less prone to decomposition than the white varieties.

LEADHILLITE. (See Vol. II, p. 6.)

The primary form of this species according to HAIDINGER and BREWSTER is prismatic, instead of rhombohedral. The left hand *e* fig. 275, inclines to the central *e* under 120° 20′, and the central *e* to that on the right hand under 119° 50′; *a* on the left hand *e* =90° 29′.

NATRON. (See Vol. II, p. 77.)

It is often observed within the crater of Vesuvius sublimated among the crevices of hot lava. It is common also on the walls of old mines and cellars. The most abundant deposit is the soda-lakes of Egypt; it likewise occurs in the hot springs of Carlsbad in Bohemia and Rykum in Iceland.

ONKOSIN.

Massive: composition impalpable. Fracture splintery to imperfectly conchoidal. Color light apple-green, to greyish and brownish. Lustre vitreous to resinous. Translucent. Hardness between 2·0 and 3·0. Sp. gr. =2·80.

1. Before the blow-pipe, swells up and easily melts into a white, blebby, vitreous and somewhat translucent glass. With borax, it gradually forms a transparent and colorless glass.

2. *Analysis.*

By KOBELL.

Silica	52·52
Alumina	30 88
Magnesia	3·82
Protoxide of iron	0·80
Potash	6·38
Water	4·60

3. It occurs in small roundish masses in Dolomite at Possegen near Tamsweg in Salzburg. It closely resembles Figure-Stone.

PHILLIPSITE. Staurotypous Kouphone-Spar. HAIDINGER.

Crystalline form, scarcely different from that of Harmotome.

Lustre, color, transparency and hardness also identical with those of the same species.

Sp. gr. =2·0 . . . 2·2.

1. *Analysis.*

By GMELIN.

	from Marburg.
Silica	48·02
Alumina	22·61
Potash	7·50
Lime	6·56
Water	16·75

2. It occurs in large translucent crystals in the cavities of amygdaloid at the Giant's Causeway in Ireland; forming groups of sheaf-shape aggregations at Capo di Bove near Rome; at Aci Reale, on the eastern coast of Sicily, Marburg in Hessia, Lowenstein in Silesia and among the Lavas of Vesuvius. The specimens from Aci Reale present elongated crystals, which adhere closely together, and radiate from a centre in globular concretions. It has also been found with Gmelinite in the island of Magee, Antrim county, in minute flesh-red colored crystals, coating cavities of amygdaloid.

PURPLE COPPER-ORE. (See *Variegated Copper.*)

PYROSKLERITE.

Massive. Cleavage parallel with the faces of a rhombic prism. Fracture uneven and splintery. Lustre on the cleavage faces feebly pearly, in other directions it is dull. Color, apple-green to light greenish grey. Hardness between 2·5 and 3·5. Sp. gr. = 2·74. Streak white.

1. Before the blow-pipe it fuses with difficulty into a greyish glass. With borax, it slowly yields a glass colored by chrome. It is decomposed, when in the state of powder by concentrated sulphuric acid.

2. *Analysis.*

By KOBELL.

Silica	37·03
Alumina	13·50
Magnesia	31·62
Protoxide of iron	3·52
Green oxide of chrome	1·43
Water	11·00

3. It occurs at Elba with Chonikrite. It seems to be closely related to Picrolite.

RAPHYLLILE. (See *Hornblende.*)

RETINALITE. (See *Serpentine.*)

RHOMB SPAR. (See Vol. II, p. 164.)

Analysis.

By STROMEYER.

Magnesia	41·06	42·40
Protoxide of iron	8·57	7·47
Oxide of manganese	0·43	0·62
Carbonic acid	48·94	49·67

SASSOLIN. (See Vol. II, p. 171.)

The deposit of this mineral occurs within the crater of Volcano, one of the Lipari Islands, where it forms thin coatings on the surface of sulphur, and around the openings, whence the subterranean exhalations are discharged. The variety deposited by the lagunes of Tuscany and the hot-springs of Sasso is of a greyer color, and harder than that from Volcano. According to KLAPROTH, it contains 11 p. c. of sulphate of magnesia, and 3 p. c. of sulphate of lime.

For economical purposes, it is obtained at Pomorance in Tuscany, by causing the volcanic vapors which arise in that vicinity to pass through water, and then evaporating the impregnated fluid in leaden vessels.

Silicate of Cerium.

In regular hexagonal prisms. Cleavage parallel to the axis of the prism. Color pale, yellowish brown. Translucent.

It is found with Emerald in Dolomite at Santa Fé de Bogota in Peru.

SODA-NITRE. (See Vol. II, p. 186.)

This salt is employed in the manufacture of nitric acid and salt-petre.

Steinmannite.

Primary form. Cube. Secondary form. Regular octahedron.

Cleavage parallel to the cube imperfect and scarcely visible. Fracture uneven. Surface of the crystals smooth. Lustre metallic. Color pure lead-grey. Hardness =2·5. Sp. gr. =6·833. *Compound Varieties.* Botryoidal. Massive, composition fine granular. In some varieties a curved lamellar composition is visible. Composition also compact, sometimes porous.

1. When heated before the blow-pipe, on charcoal, it decrepitates with violence. Its powder heated, emits the odor of sulphurous acid, and a metallic globule remains as in the case of Galena, but which finally yields a distinct button of silver. It appears to consist of lead, antimony, silver and sulphur.

2. It is found at Przibram with Quartz, Blende and Iron Pyrites.

Titaniferous Cerite.

Color blackish brown. Lustre vitreous. Fracture conchoidal. Hardness equal to that of Gadolinite. When heated it swells up; it is acted upon both by acids and alkalies.

Analysis.

By Laugier.

Oxide of cerium	36·00
Oxide of iron	19·00
Lime	8·00
Alumina	6·00
Water	11·00
Oxide of manganese	1·80
Silica	19·00
Oxide of titanium	8·00

It is found on the Coromandel coast.

URAN-BLOOM.

In small crystalline flakes. Color bright yellow, between lemon-yellow and sulphur-yellow. Opake with little lustre.

1. When slightly heated before the blow-pipe, its color becomes orange-yellow. It is soluble with effervescence in acid, yielding a yellow solution, which affords a brown precipitate with prussiate of potash, thus proving it to be a carbonate of uranium.

2. It occurs in silver veins at Joachimsthal in Bohemia, with Pitchblende and Pharmacolite.

URANITE.

It is found in small quantity in thin yellow scales at Middletown, (Conn.) where it exists in granite associated with Columbite, Apatite and Albite.

VANADIATE OF LEAD.

There appears to be no reason for separating this mineral from Pyromorphite. It is imperfectly crystallized in hexagonal prisms, and botryoidal, as well as in thin coatings. Color straw-yellow to reddish-brown. Opake and dull. Before the blow-pipe, in a pair of forceps, it fuses, and on cooling retains its yellow color; if kept for some time in fusion, however, it is changed into a steel-grey porous mass, which upon charcoal, yield immediately globules of lead. Alone, on charcoal, it fuses readily, exhales the odor of arsenic, is reduced, and leaves, after heating in the inner flame, a steel-grey, very fusible slag, which exhibits the reactions of chromium. It forms green solutions with the sulphuric and muriatic acids, and a beautiful yellow solution with nitric acid. The variety from Mexico, according to BERZELIUS, consists of

Chloride of lead	25·33
Vanadiate of lead	74·00
Hydrous ox. iron	0·67

It occurs at Wanlockhead in Dumfriesshire, sprinkled over Calamine.

END OF THE SECOND VOLUME.